IN THE ISSUE OF MARCH, 1930

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XUM

Scratchboard drawing by J. B. Settles

FLIGHT

Flight is a flash of silver on the sky,
  Unwearied traverse thru a crystal space,
A far, untarnished challenge and a cry,
  And effortless motion that is fluid grace.

Flight is a shaft of sunlight on a hill,
  A bird's wing shadow on the autumn grass,
Beauty wrought of man's indomitable will,
  Boundless as the clouds that pass.

Flight is the realization of a dream,
  The poetry of passage and the goal
The polished sweep of seagulls and a gleam,
  Of the infinite given to the soul.

Ruth N. Potts.

"Simple duty hath
no place for fear"
Whittier

From THE PUBLISHER'S QUILL

Aeronautics ADVOCATES

A unified air service with adequate appropriations.

A great National Air Academy.

Repeal of tax on gasoline sold on air fields.

Unified State and National laws governing aircraft.

EMERGENCY LANDING PLACES

THE news has featured of late a number of emergency landings, in several of which there have been more or less serious crackups.

An attempt has been made from several points to legislate restrictions to flying over crowded areas and places where a forced landing might carry elements of danger to both pilot and others.

The very nature of aviation adds a spectacular connotation to every mishap, leading to distortion of the actual conditions in the average mind.

The one fact which always remains, is that despite the newness of flying and its lack of full orientation to the economic life and structure of the country, there have been relatively the same number of accidents and fatalities per mile covered, as in any other type of mechanical transportation.

Our solons and public-spirited citizens would never dream of advocating restriction in reference to automobiles or busses merely because of occasional accident; a theory of this sort is untenable and the product more of emotion than actual need.

Requirements would seem to be more along the lines of assisting the infant industry than curtailing its scope.

O. M. "Rusty" Bounds, veteran pilot and General Manager of Garland-Clevenger in Tulsa, has an interesting solution in mind in this regard.

He believes that good use might be made of the public roads at various points, by staking off several hundred feet of road, and both air and ground-marking it, to cover necessities of forced landings.

A warning system, perhaps of the siren type, could be evolved, so that motorists could clear the necessary portion of road in plenty of time to accommodate the landing flyer.

It might even be wise to greatly widen roads at these points somewhat along the order of bridle paths which sometimes parallel concrete highways, so that automobilists might turn off to make room for a descending flyer.

This plan with variations, may be accomplished by some national agency with the cooperation of the various counties and states.

With widely separated flying fields, for the most part the only available places for a pilot to "set down," the young industry is somewhat under handicap.

To make flying as ordinary as other accepted types of transportation, the frequency of landing places must be enormously increased.

From the writer's viewpoint, the largest benefit would be in the solacing of the public mind, adding an assurance of perfect safety in almost any remote contingency.

The actual figures of relative safety compared with other types of travel should speak for themselves, but the public at large seems to overlook this, eyeing principally the remote chance of forced landing.

The value of removing this mental hazard from the average mind cannot be over-estimated.

Long Mr. Bounds' suggestion, should be given careful weight.

At first blush it carries elements of fantasy, but "Rusty" who is an executive of long aeronautical experience, seems to have a sound thought here.

GOVERNMENTAL REGULATIONS

SEVERAL bills have recently been introduced before Congress concerning governmental legislation over various phases of aviation. Senator Bratton of New Mexico is the author of a bill which proposes to authorize the Interstate Commerce Commission to regulate rates, schedules and operations of air transport lines. Our opinion on this important matter has been discussed in previous issues. Senator Bratton, quoting the writer in the December 26th issue of *Public Utilities Fortnightly*, says:

"There is disagreement as to whether interstate air commerce should be subjected to regulation now. Officials of air transport companies are disagreed regarding the matter. It is worthy of note that many of them favor reasonable regulation as desirable for the well-being and proper development of this relatively new form of transportation. This division of sentiment manifested itself during a conference of executives representing many of the leading companies engaged in the industry, held in Kansas City, Mo., last month. The magazine, "AERONAUTICS," in its October 1929 issue, states that a questionnaire touching the subject was sent to officials of many of the leaders of the industry and that 46 per cent of those replying favored regulation while only a slightly larger percentage opposed it, thus reflecting the fact that a substantial element favors reasonable supervisory regulation. In the light of history, this is an unusual showing and evidences the fact that the aircraft industry is, in its views

[*Continued on page 76*]

ENCOURAGING

A Scathing Denunciation of

by John B.

MANY dealers have discovered the fact that airplanes are automotive vehicles that do not always readily lend themselves to the accepted and conventional sales routines employed successfully with other automotive vehicles. Up to a sharply defined point airplane selling takes on the outward aspects of auotmobile merchandising—and then the resemblance suddenly ceases. A simple substitution of aeronautical jargon for that of automobile terminology is far from being sufficient unless it is accompanied and supported by a revised sales policy and an appeal to a somewhat different clientele. Merely to substitute the word "wings" for the word "wheels" finds us miles away from our final objective.

To my mind, the final solution lies in a concentrated educational campaign among men and women who have the will and the money to purchase airplanes, but who are now deterred from purchasing by false conceptions of the scope and application of the airplane. The present day prospect fully understands that mechanical flight is practicable, that amazing records have been hung up in the way of speed and endurance, but he still remains to be educated on the application of aviation to his own purposes and pursuits. Another barrier that must be torn down is the so-called age barrier that is now limiting interest to the young men of the present generation and is excluding the interest of older and financially stronger prospects. With an industry confined to a narrow class of customers, and the aviation industry is alone responsible for this attitude, we prohibit further development and demand. The public must be convinced that the airplane is an automotive vehicle accessible to all classes and amenable to all conditions before much further progress can be made.

As an individual, the airplane prospect more nearly resembles the potential automobile customer of 25 years ago than the matter-of-fact automobile buyer of today. If a close analysis were made of his mental processes, and this applies to most men between 16 and 60 years, it would be found that he is torn by two desires, both of which eventually react strongly against the immediate purchase of the plane and which are primarily due to unguided information. Desire No. 1, his secret ambition, is to "show-off" before his friends. Desire No. 2 is to see his picture in the newspaper with a wreath of flowers about his neck proclaiming him as the winner of the 1,500,000 mile race across the Hindu Alps. Before such a man can be made a legitimate patron of aviation he must first be weaned away from the romantic and brought down to the realm of practicability.

In short, the individual has the wrong perspective of aviation as a whole, and it is strictly up to the industry to set him right before he will indulge in what he at first believes is a "whim." This attitude is nothing new, for 25 years ago the typical auto-maniac suffered with exactly the same brand of hallucinations. At that time he firmly believed that all motordom was concerned exclusively with the winning of the Vanderbilt Cup Race and the Coupe Gordon-Bennett, but by degrees the Automobile industry coaxed him away from the visionary and brought him face-to-face with the more useful and practical phases of motoring. At that date the automobile bore the name of the "rich man's toy," but this title would hardly apply to the automobile of today. All sales progress made in motoring has been the result of continuous lectures on practicability and the direct application of the car to everyday life.

Dare-devil exploits, cup races and carnivals are all very useful in the inception of an industry to keep it alive in the minds of the public until more useful phases are developed, but they

The author in furnishing the photograph at the left, taken in 1912, illustrates the similarity between this early plane and the modern production model shown at the right.

SALES SLUMPS

Modern Airplane Sales Tactics

Rathbun

John B. Rathbun's opinions deserve careful consideration in view of his aeronautical and engineering experience, dating back over 30 years. He is a pioneer aircraft and engine designer, founder of Chicago Aero Works (1909) and author of several well-known technical books on aviation.

are harmful if persisted in beyond a certain point. What aviation really needs at the present time is more emphasis on the many practical features of aviation, and fewer stunt flights that only have a news interest at the most. When the public becomes more acquainted with the manifold useful activities of planes now in the service of individuals and corporations, just then and no sooner can we expect an uptrend in the sales graphs. It is interesting to know that So-and-so flew to the height of 50,000 feet but this news flash creates no desire for ownership with the average layman. True, it keeps him from forgetting that there are such things as airplanes, but that is about all.

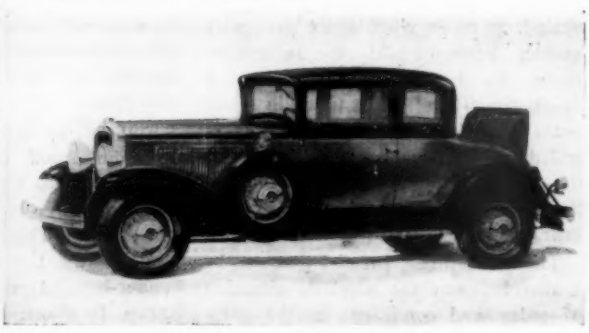
To get a complete picture of the aviation situation, let us step back to 1909-1911, a period that was far more hectic aeronautically speaking than the present time. Here we find that the public was first awakened to the possibility of mechanical flight, and among the most intensely interested were those who openly and enthusiastically envied the ten-dollar-per-minute men who were painting the word "aviation" on the banners of street carnivals and circuses. As is usual in such cases, the supply of aerial acrobats soon exceeded the demand and a dark blue slump ensued that lasted well into the period of the World War. The Man-in-the-Street, the ultimate consumer of everything from airplanes to zebras, was by this time convinced that aviation was only a circus stunt and was interested no further in the subject.

Then came the World War with much of the profit distributed among wagon builders, piano manufacturers and mandolin makers, but which was without much significance to the smaller members of the aeronautic industry, except that it threw several thousand trained pilots on the market with a yearning for ownership—but with no cash. If directed along proper channels, the boosting of the ex-army pilots would have created a rising market in 1919, but unfortunately the military idea persisted and our prospect, the Man-in-the-Street, was even further from being a prospective purchaser than before. The prevailing public opinion at this time, uncorrected by any counter argument by the industry, held that the airplane was essentially a military arm, and being such, held no more personal appeal nor desire for ownership than a machine gun. This attitude again lost the airplane manufacturer a good eight years of production.

Lindbergh's Transatlantic flight, and the front page newspaper publicity connected therewith, placed aviation in the sun and came nearer to selling aviation to the layman than any previous exploit. The wide and intense interest attending this feat has only been rivaled the activities during 1909 and 1910. It has lasted much longer than before and has witnessed more consistent merchandising than before, but still the merchandising methods must be further developed if the progress during the next decade is to keep pace with the trend during the past three years.

Present merchandising methods still lack the personal appeal to the only man that really counts, the Man-in-the-Street. He is still an enthusiast on flight in general but still remains to be sold upon that basic principle of all successful merchandizing — personal utility and practicability in his own hands and in his daily activities. Perhaps he still cherishes the old illusions of aviation romance and adventure; very likely he does, but this gilded dream will not lead to an immediate investment of $2,500 and upwards in cold cash unless something more than romance accompanies the transaction. On the contrary, if he can be shown that the airplane is the logical companion of the automobile, from which he can expect a reasonable return in service or money, then he automatically

The progress made in automobile design is indicated by the 1912 model, shown at the left, with the 1930 model of the same make.



becomes a convert. As Col. Smith puts it, "There has been too much swank and not enough sweat in airplane selling.

And again, we still have that old error in airplane merchandising that has existed from 1908 to the present time, the obstacle that the industry has willingly, knowingly and consistently put into its own path. This is the proclamation plastered up in large red letters: "Young Man Fly." Why does the manufacturer limit himself exclusively to young men? Why create the impression that only the young can become active in aviation? When you are in the throes of propounding this sort of propaganda just consider for the moment that the young man sometimes drives the family car but that the old man buys and pays for it. There are a lot of active old spirits, 50 years of age and upwards, who would like to fly and who could fly successfully if given the slightest encouragement.

An example of high-pressure salesmanship in the early days.

It is now the problem of the airplane manufacturer to develop a new clientele and to push his product into new territory. This new territory is the most promising of all fields if former restrictive classifications are avoided and if the creed of utility is preached instead of purveying amusement or stunting to an extremely limited percentage of the population. After 20 years of merchandising in the reverse direction this educational campaign will take time, persistence and money, but it is a necessary surgical operation that must be resorted to after so many years of neglect. Success along these lines has been attained in many other lines of endeavor, the automobile trades included, at times when some particular branch seemed sold to saturation. Radio, for example, has performed a "right-about-face" three times in seven years and the radio manufacturer is still doing a volume business in spite of the fact that the market had reached the theoretical saturation point several years ago.

There is a direct parallel that can be drawn between the airplane situation of today and conditions in the automobile industry during the years 1906 and 1907. At that time the automobile market was apparently sold to the saturation point, and just as today, there was a financial panic and stock market frenzy at hand. As a matter of fact, general business conditions were far worse than they have ever been in 1929, and yet it was at this time that the automobile trades first really found themselves. Sometimes it takes a crisis of this sort to develop a market, and further, to develop selling brains.

Year after year the automobile dealer had been selling exclusively to a certain limited class of trade, just as with the airplane dealer of today, without a thought of future expansion or outlets and selling the same old class of car over and over again to this restricted clientele. Cars selling for $2,500 and upwards were the standard merchandise of the times with only a few low price cars spotted here and there among the "rich man's toys." Then, in 1906-1907 came the panic, and with this panic came a very decided shortage of the old time aristocratic customers who had evidently been caught "on the market." It is my recollection that only 12 or 15 cars were sold during a whole week of the 1907 Chicago Automobile show, and to make matters still worse, the customers started dumping practically new cars on the market for about one-third of their value. The result was chaos.

And yet, up in a dark corner of the Coliseum stood the solution of the whole problem, a master-piece of merchandising invented during these troublous times. This was the old Ford Model "R," the first four cylinder "under-hood" type to sell for less than $2,000. In short, Ford genius had anticipated just this condition and had definitely located a market in a time of stress that was eventually to prove the greatest of all outlets—automotive sales to the masses at a price that made automobile transportation practicable for all classes. The threatened disaster to the automobile business, loudly heralded by all the financial "experts" did not transpire. There is no doubt but a similar drastic change will and must take place in the airplane merchandising methods. An industry must go forward or backwards, it cannot stand still, and to go forward means greater volume of sales and a wider and more comprehensive field of operations. This may mean the development of an entirely different class of merchandise in addition to improvement in sales methods, or it may mean a complete reconstruction from the ground up, who can say? But in any event it is certain that we must snap out of our present deluxe market ideas and get down to earth with a new demand that will lead to volume production.

Airplane sales to that class known as the "millionaire sportsman" have dribbled along for years without much total result. True, the wealthy man was of great assistance during the primitive stages, but he is not the ultimate market nor even a small percentage of the ultimate market. As with the early automobile dealer there has always been a strong partiality for the blue-ribbon or high-brow trade to the exclusion of the middle class who is really much the better spender of the two classes. Count the number of Pierce-Arrows on the street today and then compare them with the number of cars selling below $1,500, and you will get what I mean.

There have always been too many dreamers, promoter types and visionaries in the airplane game and a dearth of hard-hitting production salesmen. If a few red-hot radio merchandisers could be transfused into the blood stream of aviation this would help matters a whole lot. To listen-in on the various sales intrigues, distribution plans and "hammer 'em down" policies

[*Continued on page 71*]

WHAT A BANKER THINKS OF THE FUTURE OF AVIATION

by John W. O'Leary

Former president of the Chamber of Commerce of the United States, former president of the Chicago Association of Commerce, appointed by President Coolidge as United States delegate to the International Economic Conference at Geneva (1927) and now president of the National Bank of the Republic.

IN talking or writing or thinking about the present and the future of aviation, it is a very common and customary thing for us to compare the airplane with the automobile. And, of course, there are very natural reasons why we should do so.

Both are essentially means of transportation. Both, unlike the steamship and the railroad, may be owned and operated by the individual. Both, unlike the bicycle, are propelled by motor. Both, unlike the motorcycle, may carry several persons as easily as one. Both, unlike horse-drawn vehicles, may be operated almost continuously and for great distances at a high rate of speed. For these reasons, and others, there can be no doubt that the airplane and the automobile have much in common —so much, in fact, that many logical comparisons may be made between them.

Usually, however, in making such comparisons, we ignore some very important facts. It is customary, for instance, to compare the *present* status of the two industries, forgetting, in doing so, that the automobile is at least 10 years older than the airplane and, insofar as popularization is concerned, it is 15 years older. In order to get this fact clearly in mind, let us turn back the pages of history for just a moment.

The first "horseless carriages" in this country—cumbersome electric conveyances—appeared in 1891 and 1892, but it was not until 1893 that they functioned to such an extent as to be given even casual recognition. For 10 years thereafter, in spite of constant improvements, the automobile was so unsatisfactory and so erratic that it took its place with the mother-in-law as the stock joke of the country. As late as 1904, "Life" published this quip about it:

"Yes, I enjoy my automobile immensely."

"But I never see you out."

"Oh, I haven't got that far yet. I am just learning to make my own repairs."

Of course this was somewhat of an exaggeration for—by 1904—there were many companies engaged in the manufacture of automobiles, and several thousand were in use. It was nevertheless still regarded as a toy or a luxury, depending upon the point of view. And it was not until 1907—three years later—that the industry became so important as to really interest capital. In other words, it took the automobile nearly 14 years to evolve from an electrical monstrosity into an industry of national importance.

It was in 1903—ten years after the advent of the first "horseless carriage" that really showed possibilities—that the Wright Brothers made their first successful flight at Kitty Hawk, N. C., but, oddly enough, it was not until 1908, five years later, that the Wrights, returning to the same place with their improved machine, actually proved to the world that the secret of flight had been discovered. So, though 1903 is usually given as the date of the "invention" of the airplane, it was not until 1908—due to public skepticism—that the Wright Brothers' biplane received public recognition.

In other words, taking this as the correct date of the beginning of practical aviation, it will be seen that the automobile, which was accorded its first public recognition in 1893, has really had a 15-year head-start on the airplane. Consequently, if we are to make a fair comparison between the two industries, we must necessarily compare the present condition of the aviation industry with the condition of the automobile industry 15 years ago—at the beginning of 1915. Then, and only then, do we get a fair basis of comparison.

In doing this we find that there were approximately 600,000 automobiles built in 1914 as against about 7,000 airplanes in 1929. In other words, the automobile—in its 21st year—was 85 times as popular as is the airplane in its 21st year. On the same basis, the automobile, with its present production of 5,600,000 units, is six times as much used today as it was 15 years ago. So, if the same ratio were maintained, we would be building 42,000 airplanes in this country 15 years hence—when, relatively speaking, the airplane will have attained the same age as the motor car of today.

Now that, of course, would be quite a large number of airplanes, yet, as a matter of fact, it is hard to believe that anyone would be so foolish as to believe an estimate of that kind. On the contrary, the production of airplanes has increased nearly 600 per cent in the last four years and—with new airports being constantly opened, and with the whole science of aviation undergoing tremendous changes each year—it is altogether more likely that we shall number our planes by the hundreds of thousands, possibly millions, 15 years from now than it is that we shall be building a mere 42,000 per year.

Every industry must pass through ten stages before it attains stability.

XUM

That is, every industry that is the outgrowth of an invention. These ten stages are: (1) Vision, (2) Study, (3) Experimentation, (4) Solution, (5) Perfection, (6) Practicability, (7) Usefulness, (8) Public demand, (9) Adequate financing, (10) Quantity production.

The aviation industry has now reached its eighth stage. Without a question of a doubt there is a tremendous public demand for planes. America—particularly Young America—has become air-minded since Lindbergh spanned the ocean in his epochal flight of 1927. Every young person *wants* to fly and is anxious to fly. Most older people share the same desire. But, you may say, if that is true why is it that more airplanes are not being sold? Why is it that the 1929 production and sales did not come up to expectations? Why is it that the airplane industry is finding itself, for the first time, with large numbers of unsalable planes on its hands?

The answers to these questions, it seems to me, are not difficult to find. First of all, is the factor of cost. Airplanes are still too expensive for the majority of young men and young women to buy and maintain. Second, is the matter of housing. Granting that a young man buys a plane and knows how to fly it, where is he going to keep it? The only answer, of course, is at one of the airports or fields. These, however, are usually located a great distance from his place of business or his home and lack the convenience of a garage in the backyard. So, for the time being, in spite of his desire to fly, he prefers to own a car. Third, is the time element. Young men and young women find it difficult, as a rule, to find the time to learn how to fly. It isn't hard, it is true, for a young person to learn how to fly. It doesn't take a great many lessons. Yet the fact remains that it requires more daylight hours than the average young man or young woman has at his or her disposal. So, though they possess the desire, they do not possess it to a great enough degree to make the sacrifices necessary to learn the art.

In the case of older people, we find these same objections plus a great fourth objection. That is the element of fear. Whatever statistics may prove to the contrary, the average adult still looks upon flying as dangerous. Even though he may be perfectly willing to take a flight with a responsible—and sometimes irresponsible—pilot, he is afraid to learn how to fly himself. Besides, he looks upon flying as a sporting proposition. As a utility he cannot see where it offers any advantages over his automobile. And—except for long distances—it really does not. You can drive your car to your office, you can drive it to call on friends, you can drive it when you wish to go shopping, you can drive it in all kinds of weather; you can get it out of your garage in five minutes; it is always handy. But certainly, as yet, you cannot make the same claims for a privately owned and operated airplane. It is, as we all know and recognize, these factors and these objections that curtail the purchase and use of airplanes by individuals. Someday they will be overcome, but, until they are, the airplane will not be used as commonly nor as extensively as the motor car.

I have dwelt on these facts somewhat at length because I think that the greatest of all mistakes is to imagine that the airplane will shortly supplant the automobile. The two, it seems to me, serve entirely different purposes and must for sometime to come. Certainly they must until some device is perfected whereby the plane can be made as convenient to house, to use, and to operate as the present-day car. Further than that, I have no desire to prophesy, for I am reminded of the man who had this to say about automobiles in *The Literary Digest*, of October 14, 1899:

"The ordinary horseless carriage is at present a luxury for the wealthy; and although its price will fall in the future, it will never, of course, come into as common use as the bicycle."

We laugh at that now, and well we may, yet the opinion thus expressed was a very common one 30 years ago. Few people—probably none—imagined in that far-off day that there would *ever* be 26,562,713 automobiles registered in the United States, yet all types of motor vehicles included, that is the present registration.

While I am doubtful that the airplane will ever take the place of the automobile—and let us remember, by the way, that there are more bicycles produced today than there were at the height of the boom period of the nineties—I can very easily visualize the time when hundreds of thousands, and very likely many millions, of airplanes will be in active service in this country. In fact, I do not question that they will become, in time, the most popular and widely used type of vehicle. But, before that day arrives, many changes will have to be made in the conditions under which we live. Meantime, for the good of the industry itself, it is far better that aviation "make haste slowly." That is, slowly enough to permit of *sound* development.

While the airplane was first flown in 1903, first recognized in 1908, and first used extensively during the World War, it is only within the last few years that it has evolved into a great industry. That, however, is not surprising. It took the railroad industry a hundred years to reach a state of real stability. It took the automobile industry 20 years to find itself. Consequently, these facts considered, the aviation industry is indeed a very remarkable and precocious youngster. Probably no industry in our history, unless it be radio, has ever demonstrated such amazing growth. And, like radio, it has had the same problems to meet—the problems of keeping pace with the demand without, at the same time, building too top-heavy a structure. Nearly every industry, during some phase of its commercial evolution, passes through these stages: (A) Expansion, (B) Overproduction, (C) Corrective deflation, (D) Consolidation of capital and energy, (E) Stability and maturity.

The aviation industry, without much question, is now undergoing some "corrective deflation," which is the reason, of course, that only 2,000 more planes were built last year than in 1928. It is also going through the stage of consolidation of capital and energy.

Figures prove these statements. Going back to 1925, we find that 789 planes were built in this country, 50 per cent of which were for government purposes. The next year, 1926, 1,186 planes were constructed in this country. In 1927, the production had increased to 1,995. This was the year of the Lindbergh flight, and of the period when interest in aviation was at fever heat, the result being that plane production was "stepped up" in 1928 to about 5,000. At the beginning of 1929, it was the belief of most manufacturers that from 12,000 to 15,000 planes would be required, and schedules were arranged on this basis. However, according to the latest estimates available, production was actually about 7,000 to 7,500 planes. This was, of course, somewhat of a disappointment yet it marked a substantial and normal increase over the figures of 1928.

According to reliable authorities, however, there has been some overproduction, though not enough to be serious. It has nevertheless brought about some "corrective deflation" and has been responsible in some measure for the consolidations that have occurred during the last eighteen months.

From an industrial and financial standpoint, the aviation industry may be roughly divided into eight divisions, as follows: (1) Holding companies, (2) Aircraft manufacturers, (3) Motor manufacturers, (4) Accessory companies, (5) Transport companies, (6) Airports, (7) Finance companies,

[*Continued on page 72*]

ON THE TEST BLOCK

by

S. R. Winters

■

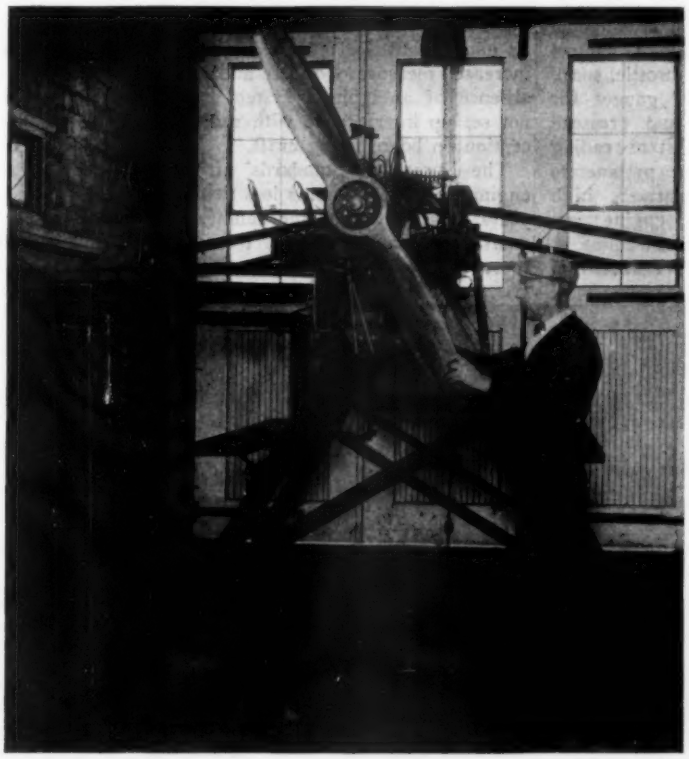
A GOVERNMENT proving ground for aircraft engines — where power plants of licensed airplanes are tested and their fitness certified—has been established by the Bureau of Standards, United States Department of Commerce. Located on the outer fringe of the experimental farm of the Department of Agriculture, Arlington, Va., the entire atmosphere is suggestive of an inquiry into the qualifications and claims of things seeking perpetuity.

Not altogether by design, however, was the site of the new aircraft engine testing laboratory determined. But, strangely enough, such an involuntary circumstance as an escape from the protests of citizens against the noise of engines under test in former locations made the Arlington Experimental Farm the ultimate choice. A temporary set-up at College Park, Md., where testing was sometimes done at night, had disturbed the slumbers of near-by residents and the aircraft radio experiments had likewise suffered interference. Removed from residential sections, the present site not only overcomes these former objections but positive advantages are apparent.

Occupying a building 120 feet long, conveniently divided into a series of rooms, the new aircraft engine testing laboratory consists of three torque rooms, in which engines are mounted for test; three control rooms, where observers are safeguarded from possible engine failures and subsequent flying parts by heavily reinforced concrete walls; a shop, where the engine is disassembled and inspected; an office and record room; and a furnace room providing central heating for the entire plant. Of concrete, the complete building is designed to minimize fire hazard. Apart from the main building is a concrete structure for storage of gasoline and oil. Not hedged-in by adjacent buildings, there is sufficient elbow-room, so to speak, on the exterior of the laboratory and, with Hoover Field within a stone's throw, flight performance tests may be readily undertaken.

While not as pretentious as some of the combined research and testing laboratories of commercial companies, the new Government proving ground for aircraft engines is without a counterpart in some particulars—designed to meet the peculiar needs of the Bureau of Standards in testing engines under the air commerce regulations. Briefly, these test requirements are a 50-hour endurance run in ten 5-hour periods; full-throttle runs to ascertain the power developed at speeds ranging from 75 to 110 per cent of the rated speed; and a test of the engine installed in an airplane, although the latter test may be waived if the engine has established successful air flights. General waivers from the air commerce regulations are the engines tested by the Army and Navy and whose airworthiness are automatically certified, on request; and engines imported for service in this country and which have undergone previously successful foreign tests, according to standards of civil aeronautic regulations. Aircraft power plants from England, France, Germany, Czecho-Slovakia, and Italy, after having successfully met tests in these respective countries, are given certificates of merit in America. However, if these same types of foreign engines are constructed by American firms they are subject to tests by the Bureau of Standards.

An airplane engine under test at the new Bureau of Standards testing laboratory.



The tests which an airplane engine undergo at the new laboratory may be suggested by describing one of the torque stands (and there are three of these units, accommodating as many engines): The test stand on which the engine is stationed includes a cradle, mounted on ball bearings and free to rotate about the engine crankshaft. Flexibly associated with this cradle are the connections and controls for gasoline and oil and measuring devices. Thus the engine's torque or tendency to rotate is unhampered and this rotating action is measured by hydraulic

weighing. The test engine is mounted with the airplane propeller—using, for test purposes, propellers smaller in diameter and steeper in pitch than are employed in service conditions—and the first period of endurance run is made at full throttle and rated speed. The remaining 9 periods of the endurance test are run with the engine slightly throttled. In measuring power on a torque stand, it is necessary to apply a correction for the rotation due to the propeller slipstream. This correction may be made in one of three ways: by use of a cellular grid between the propeller and the engine, which straightens out the slipstream from the propeller and thus obviates any possible tendency of this air-stream to rotate the engine; by mounting the test engine on a dynamometer stand at the Bureau of Standards in Washington, where an electric dynamometer takes the place of a propeller; or by driving the propeller through the force of a separate motor and measuring the slipstream torque on the engine at rest.

The control room is purposely divorced from the room in which the engine is tested and a reinforced concrete wall offers protection to the crew of two observers from possibly broken propellers or flying parts while the engine is running under test. This remotely-controlled observation room contains weighing tanks in which the amount of fuel consumed by the test engine is determined, and tanks in which the oil consumption is weighed. The number and variety of control units include devices for throttle, spark and altitude adjustments; gauges for measuring oil pressure and pressure of the intake manifold; distant-reading thermometers and precise pyrometers for determining the relatively high temperatures around the engine; accurate tachometers and speed counters, and other measuring devices essential in keeping tab on a diversity of tests. As a whole, this equipment is designed to facilitate the speed and convenience in mounting, testing, and recording results.

With three torque or testing stands functioning—instead of just one as at the former temporary location at College Park—at least one completely tested engine can be turned out each week. And, as if to gauge accurately the capacity of this laboratory, commercial manufacturers of airplane engines are requesting tests at the rate of about one a week—although testing is two months in the arrears, largely due to the necessary lapse in testing while outfitting the plant and transferring activities from College Park to Arlington.

Designed exclusively for test purposes rather than research, the new laboratory is limited to running type tests of aircraft engines in which the latter are required to supply their own cooling air—the Arlington plant not being provided with external cooling systems. However, all makes of airplane engines now in service can be accommodated and, anticipating the future introduction of the Diesel type of engine as a power plant for flying machines, it, too, can be subjected to Government tests.

Incidentally, Dr. H. C. Dickinson, Chief of the Heat and Power Division of the Bureau of Standards, foresees two marked advantages in the use of the Diesel engine for airplanes—with its non-combustible feature it offers an increased measure of safety and in the absence of an ignition system it will not set up interference with radio reception on board flying craft.

The Bureau of Standards' aircraft-engine testing program is less than two years old, and despite the handicap of transitory locations for its test plant, there has been no let-up in efforts to place testing facilities at the disposal of engine manufacturers who desire to qualify under the airworthy requirements of the Department of Commerce. During the last fiscal year, for example, 26 engines were subjected to Government tests, of which number 12 failed, 5 were withdrawn, 2 are still under test, and 7 were approved. Of the 12 engines failing to qualify, only one completed half of the endurance test and 6 failed in the first period. The unprejudiced and authoritative opinion of the Bureau of Standards was that, "If those engines which failed during the last fiscal year had been put in service and flown at the speeds and horsepowers at which they were tested, they would have averaged one forced stop for each four hours of flight. How many fatalities would have resulted, no one can guess, but the number might have been large."

Still more surprising may seem the statement of H. K. Cummings, Chief of the Automotive Power Plant Section of the Bureau of Standards, that, "Less than 50 per cent of the engines so far tested have successfully met the Department of Commerce's requirements on the first trial, which shows the necessity of conducting type tests before authorizing the use of new types of engines in interstate commerce."

The Bureau of Standards exacts no fee for testing airplane engines, manufacturers merely being required to furnish fuel and oil consumed during the test. Each power plant must stand on its own merits, without the Government resorting to odious comparisons, and there are no standard requirements as to weight per horsepower or fuel or oil consumption per horsepower-hour.

The standard of performance required of each engine is: sound design, adequate materials, good workmanship

[*Continued on page 69*]

A view of one of the control rooms of the new aircraft engine testing laboratory.

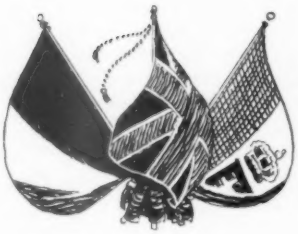
IN THE FLOODLIGHT

A presentation of government officials, who have been delegated by their respective governments to direct and promote aviation activities.

Laurent Eynac,
Minister of Aviation, France.

Dr. Schatzel,
Reichs Post Minister, Germany.

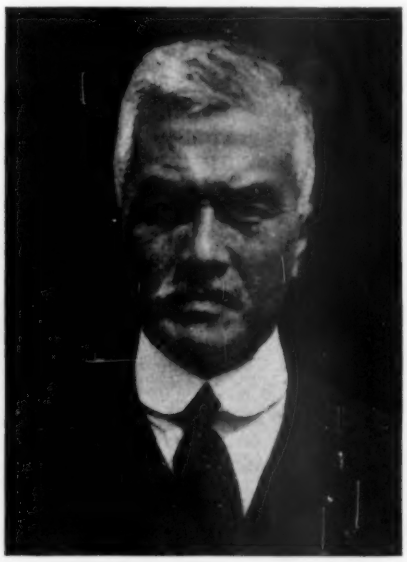
Clarence M. Young,
Assistant Secretary of Commerce for Aeronautics, United States.



General Italo Balbo,
Minister of Aviation, Italy.

Lord Christopher Birdwood Thomson,
Secretary of State for Air, England.

Baron Shiba
Director of the Imperial Aeronautical Research Department, Japan.



XUM

WINGS for

by E. Percy Noel

SINCE airmen cast their fleeting shadows on the broad waters of the Pacific in 1927 and confirmed the promise given by the successful failure of Lieut. Cdr. John Rodgers, U. S. N., in the PN9, to link the Hawaiian islands to the mainland, Honolulu people have had a new outlook on life. The fact that the pioneer came down in the sea before reaching the coast enhanced the importance of his flight from San Francisco, because it showed that failure to fly from land to land without stopping did not spell defeat, and at the same time it minimized the popular opinion of the danger of the 2,400-mile overseas run.

Lieuts. Hegeneberger and Maitland, with a three-motor Fokker, in June, 1927, piled up the evidence in favor of flying, wiping out all the old-fashioned ideas of distant islands and vast seas. There still remained some doubters among the Hawaiians, however, and the Dole prize flight from the mainland to the Islands, with $20,000 and $10,000 prizes, offered the crucial test. Art Goebel, and the others who completed this race successfully, more than counter-balanced the failures, which, whether justly or not, were attributed by Islanders—now become Mainlanders in their new air consciousness—to faulty preparation.

A year followed during which this great and joyous feeling of no longer being Americans inhabiting a remote cluster of little islands, as many days sail from the nearest land of one's own nationals as Europe is from America, began to wane. Dreamed of flights from San Francisco to Honolulu, with all the new contact with the rest of Americans that they would mean, failed to come true, and hope was fading when the Southern Cross came along, demolishing all the arguments of the pessimists. That greatest of all gloom-spreading arguments—direction-finding hazards—was shattered to bits by the Southern Cross, and today all thinking Hawaii knows that there is such a dependable route marker as the radio beacon, which means the possibility of all-weather air communication with the mainland in from 24 to 48 hours by airplane and 48, or more, by dirigible.

This was all very well, but no move was made either in the Islands or on the mainland to establish regular air connections between these distant parts of the U. S. A. Rightly enough, Reilly K. Allen, editor of the *Honolulu Star-Bulletin* and president of the Chamber of Commerce, argued that God helps those who help themselves, and urged Hawaiian people to provide themselves with airports and airplanes before they could expect mainland magnates to join them in organizing cross-Pacific air service.

The first thing to be done in the Islands was to create ports for both land and water machines, then to organize companies and bring over high grade flying stock. The first airdrome was the Ward airport near the shore, not far from the steamship piers, where for several years a good battle against hard luck has been made by the Western Pacific Air Transport company, which recently added two Travel Airplanes to its equipment. From Ward airport inter-island airplanes flew in an attempt to inaugurate regular services, and enough was done to call attention to the need and practicability of it before larger financial interests took a hand and set up the two inter-island lines which have just begun operations. For now Hawaii is served by two inter-island services, one of land machines and the other of amphibians, and there is a port or landing field on each of the six principal islands.

The Chamber of Commerce had the sound idea that the way to begin realizing on the advantages which air connection with the mainland offered was by making room for flying. Headed by President Allen and aided by the press, it proceeded to make the Territorial Legislature feel the same way about it, which it soon did, to the tune of $45,000 to make—with the money raised by the Chamber of Commerce for the purchase of land—a total of $65,000.

Are there any state owned airports on the mainland of the United States? Probably not. In which case Hawaii has the first one, to serve as a model to state capitals, which, not many years hence, may find the need of having their own.

In honor of the pioneer, the Territorial airport is named John Rodgers. This 700-acre field has the best situation which could be found. It lies in the flats between Honolulu and Pearl Harbor. The sea is only a few hundred yards from the hangars and take-off runways. It is far enough distant from the mountains which abound in these islands to avoid curious wind currents at all times. At the worst, wind is not much of a worry in the Islands, never

The John Rodgers Field at Honolulu before work on the runway was begun.

HAWAII

Looking toward Honolulu from the John Rodgers Airport.

blowing more than 40 miles an hour in the worst storms. Storms are rare, the weather is quite stable and the winds in the open spaces are normally smooth and gentle.

The water is shallow along the airport shore and this is being dredged a little to make it deeper for the seaplanes, and the dredgings are used to extend the shore and form the foundation for slips. Over at Pearl Harbor Army and Navy Airport, there is a mooring mast for dirigibles.

Commander J. C. Hunsaker, of the Goodyear company, when he looked over the John Rodgers port recently in anticipation of the forthcoming San Francisco-Honolulu Goodyear-Zeppelin service, found the conditions ideal. It was his opinion that no dirigible hangar would be needed there, and that a new type mooring mast might be set up; but he intimated that it was quite possible that the new ships Goodyear will build will require neither hangar nor mast for overnight halts on the ground. This attitude cleared an obstacle to the inauguration of the Los Angeles-San Francisco-Honolulu dirigible line which has been financed in California and Honolulu with the help of Akron.

Aviation enthusiasts in Honolulu hold the logical view that once the inter-island air services prove themselves by time, the longer airplane run—to San Francisco—will come as a matter of course. And this seems to offer a sounder future than the lighter-than-air.

Few cities in the world will ever have an airport to compare with John Rodgers field in its many advantages. Twelve miles from the center of town by actual roads, it is to be connected by a straight road which the Territorial Government is now cutting through. When this is completed it will be an easy 15-minute run by car from Honolulu to the starting runway.

Here we discovered a new material for runways, which alone is sufficient to insure the success of this airport and those of all the Hawaiian islands. This material is resilient, yet never actually soft, any more than it is sticky or slippery. There is no such thing as skidding on it. It is a material so perfect for the purpose that I wonder if it would pay to ship it to all the corners of the earth to make airplane runways. Crushed coral is the product, the coral of the islets of the south seas; the coral of this stepping-off place for the tropics, one and the same.

It is quite a hop—2,100 sea miles, or 2,400 land miles—to the nearest mainland and there are no landing places in between, if we except the Farallon Islands, just west of San Francisco bay. Although Los Angeles is nearer the parallel of Hawaii, San Francisco is the nearest port on the continent. But near or far, it is worth while to the individual in a hurry or to shippers and merchants to reduce the time by one-fifth, to make the distance in one day instead of five, which is the average steamship time.

While the radio beacon is being installed and the financing found for the obviously necessary air line from the Coast to the Islands, lines connecting all the principal islands are in effective operation, carrying their full quota of passengers and express, and bringing islands which were otherwise at best 12 hours apart, now only 1 hour 30 to 45 minutes distant.

The first regular service was inaugurated November 11, last year, by the Inter-Island Airways, Ltd., which was financed by the Honolulu Inter-Island Steamship Company of which it is a subsidiary organization. They started with two two-engined passenger Sikorsky amphibians, giving an every-other-day service on the Honolulu, Molokai, Lanai, Maui and Hilo route, and twice a week service to distant Kaui island, all going and returning the same day.

In December, the Hawaiian Airways Company, Ltd., was scheduled to inaugurate service with the Inter-Island company, using three-motor Fokkers, the plan being first to fly round trips between Hilo and Honolulu, daily, then daily to Maui island, all with freight and passengers; but it seems likely that this program will be altered to fill in the days on which the Inter-Island line does not operate to certain points.

The Hawaiian Airways is largely financed on the mainland by ex-Secretary of the Treasury McAdoo and the Nathan Newbys, father and son; while Thos. J. Edwards, president of Aircraft Securities Company, C. A. Myers of the Firestone Tire and Rubber Company, and C. E. Eakin, president of the

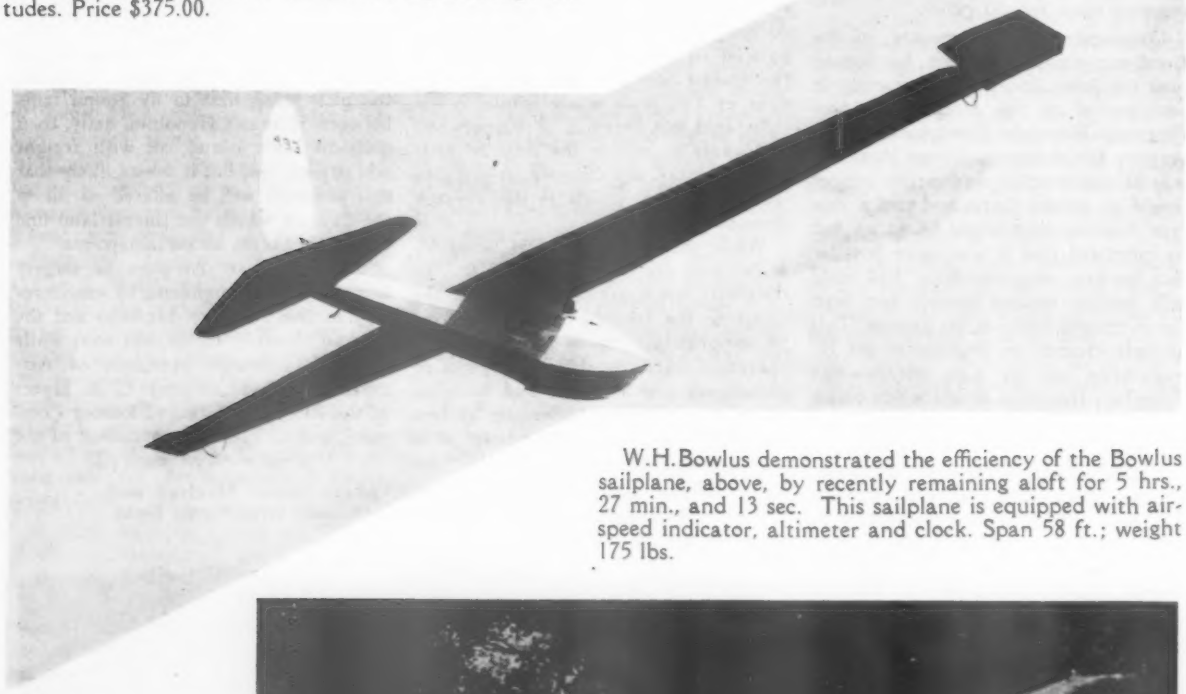
[*Continued on page 74*]

The Wheeler Field in Hawaii, where Lieuts. Maitland and Hagenberger landed after their 2,400 mile trans-Pacific flight.

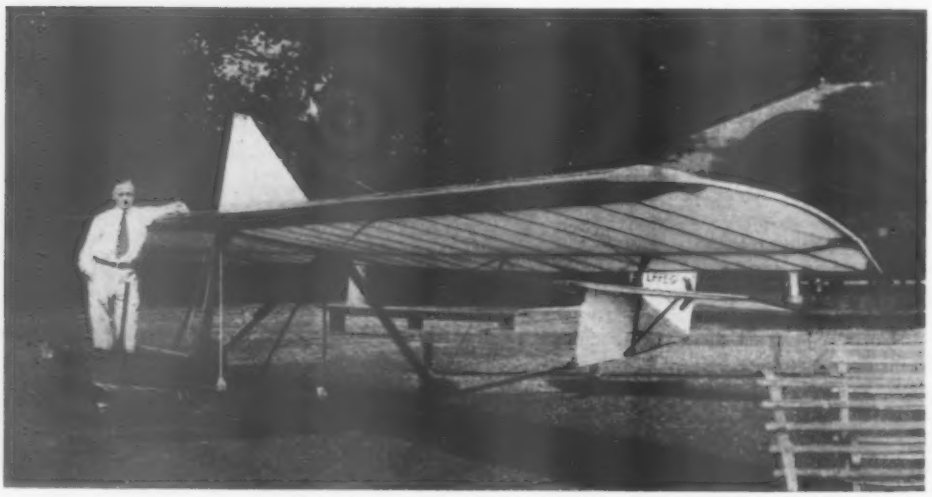
THREE OF THE LATEST

With the advent of Spring, the sport of gliding takes on added interest. Aeronautics, herewith, presents three of the latest . . . . . in gliders.

The Alexander Primary Glider, the newest product of the Alexander Aircraft Co., is constructed of welded steel tubing, and is designed for satisfactory flight in high altitudes. Price $375.00.



W.H. Bowlus demonstrated the efficiency of the Bowlus sailplane, above, by recently remaining aloft for 5 hrs., 27 min., and 13 sec. This sailplane is equipped with airspeed indicator, altimeter and clock. Span 58 ft.; weight 175 lbs.



The latest development by Gliders, Inc. This hydro-glider has been flown successfully at 30 m.p.h. when towed by motor boats. Span, 36 ft., weight 225 lbs. Price, $750.00.

"How Shall I Enter Aviation?"

A discussion of the various vocational opportunities in the aviation industry.

by

Roger M. Kyes

The Glenn L. Martin Company

THIS new industry is growing by leaps and bounds. Everyone from the shop mechanic to the seasoned executive is becoming air-minded. Believing that there is a great future in aviation, men are leaving good positions in other industries, making many sacrifices, hoping to reap future profit. The average individual is familiar with the opportunities in flying and operating companies, but very few know the possibilities in connection with the manufacture of aircraft. In order that those in other fields who desire to enter aeronautics may be able to determine whether or not their particular abilities can be utilized, it may be well to outline briefly the opportunities and the requirements of the various trades which compose the producing unit. The main divisions are Engineering, Purchasing, Production, Inspection, Accounting and Sales.

Engineering is extremely important in this as in any other technical industry. A successful airplane is dependent upon a delicate combination of design and practicability which requires extensive research. In the engineering department there are a number of groups requiring different types of minds. The first group, which is responsible for the aerodynamics of a particular design, requires the research type, capable of dealing with the theoretical. In order to work out the proper airfoils and general lines of an airplane the project engineer must have a thorough knowledge of aeronautical engineering. This type is usually produced by some outstanding aeronautical school or has gained a knowledge of aerodynamics by doing research for The National Advisory Committee for Aeronautics, The Department of Commerce, or some other like institution.

After the aerodynamics of a new plane have been worked out, its success depends to a great extent on the proper utilization of the physical properties of materials. To see that this is accomplished is the function of the Stress Analysis Department. In addition to theoretical this group requires a certain practical knowledge of structures, especially because the theoretical must in many cases be checked by practical methods such as static testing. Further, men in this group must have sound judgment in order to design structures with adequate strength to insure safety, while keeping the weight to a minimum.

The project engineering and stress analysis having been completed, the designer immediately sets about to design the various parts of the plane, such as the power plant, fuselage, wings, controls, landing gear and other detailed parts. A knowledge of production and manufacturing methods is necessary so that the design may be such that it can be economically produced. After the drawing has been completed it must be checked by the Checking Division which requires of its personnel only a minimum of knowledge about aerodynamics but a thorough understanding of shop practice and manufacturing methods, thus enabling the checker to eliminate any inaccuracies which may make a design difficult to manufacture.

These functions which have been briefly outlined could not be accomplished without the aid of a group of draftsmen who work in close co-operation with the engineer and designer in assisting them in carrying out and sketching their designs. Neatness and a high degree of accuracy together with a thorough knowledge of the symbols used in mechanical drawing are desirable in doing this work.

In addition to those who have to do with the actual design of the plane, it is necessary to have a number of staff engineers who are constantly engaged in general research together with a patent engineer who takes care of the patenting of various new designs and inventions.

After the plane has been designed in keeping with the best principles of engineering and manufacturing practice, the tool engineer must design the proper tools for its production. Practical dies, jigs and fixtures must also be evolved for the production manufacturing of the parts from engineering drawings. The tools should be as simple as possible and the manufacturing facilities utilized to a maximum. In addition to designing tools these engineers are responsibile for the arrangement of machinery and equipment for the most profitable operation.

Having outlined briefly the engineering positions in the average airplane company it is well to consider the future supply and probable demand. Engineering schools have inaugurated aeronautical courses which are giving to the industry a number of graduates having a basic knowledge of aerody-

The manufacture of airplanes entails a wide variety of activities as evidenced by this view of a Curtiss Condor Transport under construction.

namics, and who can be developed over a period of years into valuable engineers. In addition to the college graduates there are a number of engineers in other fields who are transferring their affiliations to the aircraft industry. The basic principles of engineering are fundamentally the same, hence there is no reason why a man of the proper type who is in another field of engineering can not become a proficient aeronautic engineer. This is especially true of the metallurgical engineer since the trend in modern aircraft is to metal. In the future the demand for engineers in the aircraft industry will be on the decrease because, much like the automobile industry, the aircraft industry will be compelled to resort to mass production in order to make a profit on the investment.

An exception to this statement will be found, however, in military aeronautics; for these companies are constantly designing new types, and as a rule planes for military purposes are not produced in great quantities. In consequence, the military business requires a much greater engineering staff than that of the commercial. While a decrease will take place in the need for engineers in the commercial branches, new fields of engineering will be added to the aircraft industry. The fundamental design of airplanes will not change, except possibly in the case of the autogiro; and rather than radical changes the trend is towards refinement. The elements of body design, color combination and a great many other factors will necessitate engineering research much like that which is now being conducted by the automobile companies in an effort to produce beautiful and graceful body designs. This will, of course, create opportunities for engineers especially fitted for this new development in the industry.

After the plane has been designed the materials for its fabrication must be purchased. It is extremely important that these be bought as cheaply as possible on a basis of a certain standard of quality. A knowledge of airplanes is necessary in addition to that of markets. Upon receiving a requisition to purchase materials, the Purchasing Department must select a certain source of supply from a number of reliable houses. Quality at low price is the criterion, and to accomplish this end purchasing must be done by experienced men.

After the materials have been purchased they must be fabricated into airplane parts. The designs are released from the Engineering to the Planning or Production Department which is responsible for the planning of production. This involves a knowledge of fabrication and assembly of materials and requires men of unusual ability. The method of planning production is, of course, determined by the number and type of planes to be produced; consequently, it is difficult to designate a method of production common to all aircraft factories. However, it may be said whether the company be a military or commercial concern or both, it is necessary for the Production Department to carefully plan the manufacture of planes in order to eliminate storage and unnecessary delay, and to keep a continuous flow of production without interruption in face of the many hindrances which may be experienced in manufacturing, such as the shortage of raw materials, breakdowns of machinery and other unforeseen obstacles. The way in which the Planning Department instructs the Shop to build a certain member of a plane has much to do with its cost of manufacture. By finding the cheapest possible method of producing a certain unit the total savings of the various units becomes a considerable figure.

After the method of production has been established the orders are released to the Shop which is comprised of a multiplicity of trades. This group is composed of almost every kind of labor known to technical manufacturing. There are three functions performed by the shop. The first is that of the Tool Department which makes all the tools necessary to the fabrication of parts. The second has to do with the actual fabrication of parts needed for assembly; and the third, which is assembly, may be divided into sub-assembly and final assembly. Rather than discuss each as a unit, it is perhaps, best to follow the plane through the various processes of manufacture.

The raw material is drawn from the Stores Department which is composed of a staff of storekeepers who are specialists in the handling of raw stores. Under these there are a number of clerks who look after the receiving of raw material, the listing of stock and keeping of inventory. Raw material is then taken to the tool room if it is for the making of tools or to the machine shop if for the fabrication of parts. In the case of parts it is often necessary to alter the procedure in that the metal must be properly heat treated before it is fabricated. This requires some knowledge of heat treatment as the aluminum alloys used in aircraft construction are particularly sensitive to temperature changes.

Material which is to be made into tools is first laid out by men who have a thorough knowledge of mechanical drawing and the ability to develop on wood and metal curves, angles and irregular or unsymmetrical parts. Angle projection must be sufficiently understood to permit the laying out from blue prints or sketches without the use of samples. Wood lay-out men are used by the Tool Department in making all sorts of jigs and fixtures. It is a usual function of the Tool Department to make fixtures for detailed and sub-assembly which are extremely important to accurate manufacture. To accomplish this the duties of the tool and die maker involve the highest grade of mechanical skill. Accuracy far above that required in the average machine shop is necessary. For the production and manufacture of sheet metal stampings, for example, proper dies must be made and the tool and die maker must be capable of laying out, blanking, forming and drawing other dies from blue prints and follow their construction through the various stages of machining, fitting and assembly for operation in punch presses.

A large variety of work is handled by the men in this trade, and ability to work within a thousandth of an inch is required. Patternmakers on woodwork are required to make all sorts of patterns for castings and forgings while metal patternmakers work chiefly on flat sheet work such as templates. They must be capable of laying out and projecting angles for transfer on to metal to be formed by sheet metal workers. The Tool Department also has a number of tool dressers who sharpen drills of all sizes, file and grind saws, milling cutters, lathes, shapers and such other tools as may be required. In all cases a tool must be sharpened with as little wear as possible upon it.

The fabrication of parts requires first-class machinists able to work to dimensions, clearance, lengths, and so forth, accurately within one ten-thousandth of an inch. This classification includes operators of lathes milling machines, shapers, drill presses, jig borers, slotters, hand and automatic screw machines and others. Work must be set up on the machines in such a manner that it can be done as rapidly as possible with the greatest accuracy. Because of the wide variety of parts in an airplane it is necessary that the machinist be able to handle the most intricate piece of machine work.

The Bench Department is usually a part of the Machine Shop. Bench machinists are employed to lay out, fabricate and to some extent assemble fittings and other detailed parts of struc-

[*Continued on page 64*]

ACCOMMODATING THE AERIAL DRUMMER

by

J. Don Alexander

Alexander Aircraft Co.

OPPORTUNITY rests by the roadside just outside of every American city—opportunity for the man who would build up a substantial business and make himself of service to motorized mankind.

I mean the operation of a combined auto-aircraft service station—a refueling and repair depot for the public that travels in its own automobiles and is beginning to travel in its own airplanes. The number of salesmen adopting the airplane alone will justify the aircraft end of the business.

The auto-aircraft service and repair station should be located on a large field, beside a main travelled highway and as near town as possible. It need not be an all-around, first class airport in the modern sense of the term, just a good safe landing field where planes can drop in easily for gasoline or for motor overhaul.

The backbone of the business at first will be the automobile service and repair. But gradually, as flyers learn that an operator and gasoline pump are on hand at all hours of the day, and quick service is furnished on repairs, the aeronautical revenue will mount to heavy figures.

The advantages of combining the two businesses lie in the single overhead. Some additional tools and other equipment will be needed to handle the airplane motor overhauls, and a licensed airplane mechanic will be needed. These will prove a good investment.

The auto-aircraft station will solve the airplane fueling problem in towns where air-traffic has not yet reached sufficient volume to warrant keeping a man and gasoline pump at the municipal airport. An operator can always find time from automobile servicing to take care of an incoming airplane which has just taxied up to a field pump.

Such stations will be welcomed by the growing number of flying salesmen. And the number is growing! Travelling is the bane of the travelling man's profession. Once he has flown in five hours the same distance which requires 14 hours by fast automobile or 18 hours by train he is "sold" on air travel.

But the aeronautical industry must make adequate provisions before it can expect to sell a large number of planes to travelling men and to service these planes. The greater mobility, which the plane gives them between towns, must be supplemented with the mobility which the automobile gives them within the city.

Thus another step in smoothing the way of the "air drummer" will be a series of economical airport rent-a-car services.

Today the salesman saves valuable road time by flying but begins to miss his own automobile when he arrives at the airport. Tomorrow the flier will step out of his plane, rent a fast little automobile at rockbottom rates from the airport rent-a-car service, and proceed about his business with the swiftness characteristic of the modern flying age.

The rates will be cheap because the salesman will leave his plane as security on the car, and it will be ample security. Thus the rent-a-car man takes practically no risk of theft and will be able to offer extremely low rates.

The airport rent-a-car plan may prove a means of alleviating the vexing used-car problem. Why not use the better class of used automobiles in the rent-a-car service and thus cut down initial costs?

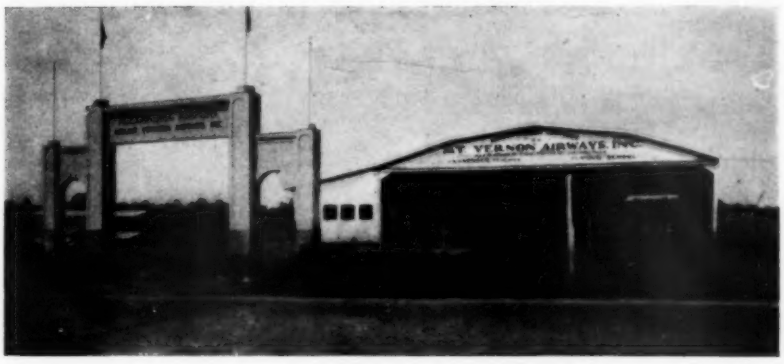
It will be immensely to the advantage of the airport operator to facilitate air travel in this manner. Private air-traffic is introducing a profitable new aviation fuel, hangar and repairs industry. It should be stimulated.

Operators of passenger airlines solve the airport-to-town problem by carrying passengers into the downtown district in fast bus or aerocar. The private flyer is accustomed to flying his own and of course would prefer to drive himself. A salesman will probably spend two or three days in a large city. He will want possession of the car from the time he leaves the airport until he returns for his plane.

In fairness to the peculiar needs of the flyer the airport service should rent cars strictly on a mileage basis, stipulating that the car be returned after a specified time or be subject to increased rates on a pyramiding scale.

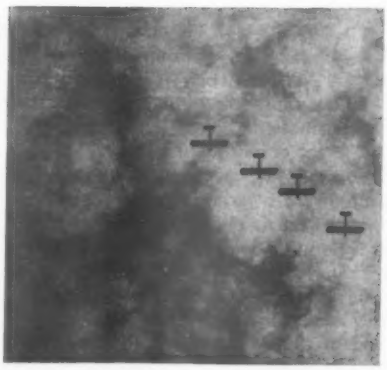
The airport service will find it necessary to reserve these cars strictly for the use of flying patrons. By renting at little over operating expenses it will underbid established downtown services. It should not be its aim to attract the legitimate trade of established rent-

[*Continued on page 70*]



Wayside airports welcome the flying tourists.

FLIGHT TRAINING



by
K. M. Painter

"PERHAPS the biggest problem in naval aviation today, in so far as its value to the fleet is concerned, is that of the observation squadron in observing or spotting the fall of shot in an engagement and getting this information through to the firing ships," says the Navy Department. And Lieut. J. R. Tague, commanding officer of Squadron Five—the Observation Squadron—at the Naval Aviation Training Station, explains that: "Successful spotting is dependent upon good visibility; without it, it is impossible to correct the fall of salvos so that succeeding salvos will hit the target. In these days of long-range guns it is probable that the ship's spotters would be unable to correct ranges. But the airplane has power to seek and maintain a position of consistent visibility. It looks down upon the opposing forces from such a height that the distortion, due to the angle from the vertical, is negligible. It can detect disposition of forces, course of enemy, bearing of enemy, detachment of forces, torpedo attacks, and other conditions of inestimable value to its own forces. It also insures accurate hits through smoke screens, low haze, and torpedo attacks. After the engagement opens, the airplane observer is the eyes of the big guns, communicating his information to his own forces by radio."

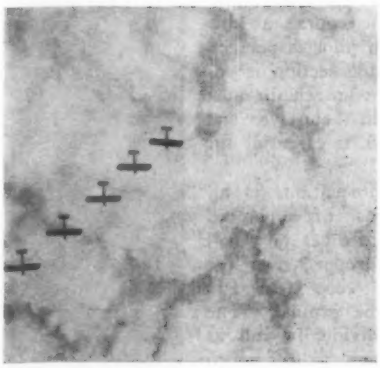
From Squadron Three, the student naval aviator enters the Observation Squadron which, although it is numbered five, precedes the Combat Squadron—number four—since the marks of Squadron Five are averaged with the previous training marks in selecting students for the fighting-plane course. The six students with the highest average gain the distinction of starting the advanced combat training, though all students below the rank of commander, and excepting enlisted men, get an indoctrination course of 18 hours in the speedy little Hawks.

As in the first three squadrons, the student receives preliminary instruction—flying UO and O-2-U landplanes in Squadron Five—and after two hours, checks out for solo. Eight hours is then devoted to practicing precision landings and perfecting air work in these, the fastest planes the student has yet flown. And the great difference between these planes and previous types that the student has piloted leads him to many antics that he grudgingly writes in the log of experience. Consider the case of a student who was landing after his second solo hour in an O-2-U when his throttle jammed. Moving at a speed greater than he had ever traveled, he made a smooth enough landing, but lost his head, and couldn't stop the plane. Lieut. Tague describes the ensuing scene as a duplicate of the one in the moving picture "Lilac Time." The student completely forgot that he could turn off his switch, and spent a thrilling few minutes dodging hangars before he came to rest in Pensacola Bay.

A modern fleet of naval planes lined up for inspection.

On April first—aptly, Fool's Day—another student had one of these planes literally "run away from him." This student was out for his first solo hop in a UO, and had a mechanic riding with him. He noticed a disabled plane riding on the water, and made an emergency landing to phone his squadron office. When he went back to his plane, the motor of which he had left idling, he was puzzled by the fact that its tail surface seemed lower than those to which he was accustomed (which is true, since a UO carries its tail closer to the ground). Investigating this, he

THE NAVY



Naval pilots flying in open "V" formation.

pulled the tail upward, and as he did so, it knocked the stick forward. This in turn pushed the throttle forward, and the plane shot out at a great speed. The mechanic, who was standing close by, made a dash for the runaway at the same time the student dashed; they collided and by the time they had picked themselves up from the ground the plane had taken-off and was headed for the woods. Attaining a height of some sixty feet, it must have felt its efforts unappreciated, for it gave up the ghost and dove landward.

Successfully completing his solo time, the student flies five hours in three and five plane Vee formations. He is then instructed in setting a line of bearing. And, now is the time when he puts his ground-school radio-training to the test. To pass the examination, he must be able to receive and transmit 27 straight words per minute and 20 words per minute in code. Observation planes are equipped with a 50-watt transmitter having three 7½-watt tubes and a sending radius of 300 miles; and a regenerative receiving set using four peanut tubes with two stages of amplification. Both sets are housed in the same case and are served by a single antenna.

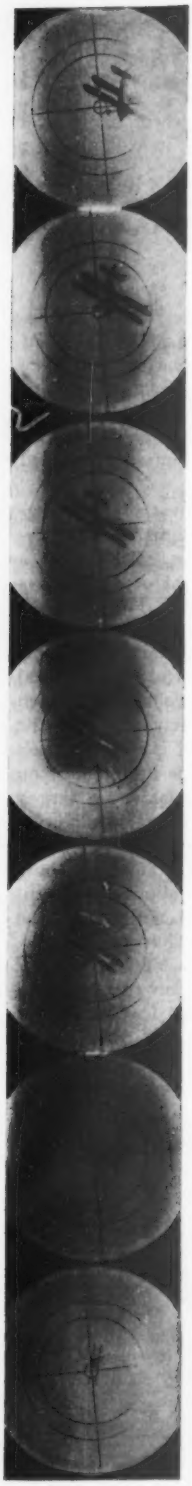
Before the student is required to do actual spotting in flight, he practices on a spotting board. The board is made of painted canvas stretched out to represent the surface of the water. A screen is elevated in front of the canvas with peepholes and a covering slide. Radio sending keys are mounted behind each peephole, and furnished with ear phones. The board is made to scale, and represents two spotting altitudes, 10,000 and 5,000 feet.

Students take their places behind the screen, by a peephole and radio key, while a like number of students put on ear phones and take places at tables outside the screen. The latter are prepared to copy the spots transmitted by their corresponding spotters. Other students place "splashes" on the canvas (which simulate the fall of salvos on water), and record the true correction for comparison with spots transmitted by spotters on the target. The peepholes are opened for about five seconds to enable the spotter to see the target and then replaced.

The purpose of the spotting board is to give a fair representation of the aspect of ships and "splashes" at different altitudes, to train the student in making a decision, and promote rapidity and accuracy in sending spots. The time of transmission, clearness, and accuracy of sending are checked by the instructor. The spots transmitted are checked with the true corrections recorded by the students who placed the "splashes."

The student then puts his spotting-board instruction to flight test, and flying in formation spots "splashes" on a ground field-board. This phase is known as Spotting Drill. The next step is Spotting Rehearsal, in which signals are received and transmitted in code. Then the student is ready to spot real salvos. Ten salvos are fired for each run. One student acts as pilot, the other as observer, and it is the latter's task to accurately guide the gunners on shore who are firing at a set target. This is accomplished by radio direction in code, from the observing plane which flies over the target. Thirteen hours spotting practice is followed by individual battle practice with fixed and free machine guns fired from the plane. Light fragmentation bombs are dropped from an altitude of 500 feet, and the student is then ready for his 4-hour

An interesting view of the Flight Beach of the Naval Aeronautical Station, Pensacola, Fla., March, 1914.



Sighting a U. O. from a Hawk. These pictures were taken by a camera gun and show a good proportion of hits.

cross-country hop which completes the training in Squadron Five.

All student officers below the rank of commander receive an 18-hour indoctrination course in the Hawks of the Combat Squadron—Squadron Four. Since these speedy little fighters are single-seaters, all preliminary instruction is, of necessity, given on the ground. Lieut. Dave Rittenhouse, former war pilot and first American winner of the Schneider cup, considered one of the most able fighting pilots in the Navy, is the commanding officer of the Combat Squadron. With his two assistants, Lieut. Rittenhouse draws diagrams on the Squadron blackboard as a means of instruction.

After practicing taxiing, take-offs, turns, and landings in these planes that have a landing-speed of 50 miles an hour, the student receives a precision landing check, and is ready for Vee and echelon formations. Eight hours of formation flying—then aerobatics! The student maneuvers for a slow-roll—considered the most difficult stunt of the entire course since it involves flying in unaccustomed attitudes and a complete reversal of control when the ship is on its back in the position of a half completed roll. This stunt is valuable in dog-fighting, when proper handling of the plane is necessary in unnatural attitudes. The last hour of the 18-hour familiarization course is devoted to an altitude test which requires a climb of 20,000 feet.

Student Naval Aviators who have not qualified for full combat training receive their first orders for flight duty, and the whole class is designated Naval Aviators. The six selected officers, whose marks were highest in the first four squadrons, report for advanced combat training.

A former combat-instructor, in discussing the fighting course, has said: "The average service flyer confronted with the qualities demanded of a fighting pilot will admit, under pressure, that he would be placed to best advantage in a fighting-plane squadron. Unfortunately this is not true. Were it true, it would not have been possible during the World War for 300 aces of the allied forces to down 2,600 opponents, nor for 100 Germans to win 2,000 victories over allied flyers. Assignment to fighting-plane duty carries with it no assurance of eminent fitness. It can only provide the means with which the pilot may work for self-development. Preliminary and advanced courses of training in aerial fighting can do on more than provide the tools with which the pilot works, expound the elementary principles of aerial tactics, afford means of practice, and so give some slight contribution toward the experience required. Most of the development must come from within."

For obvious reasons, the tactical problems considered in Squadron Four can not be discussed, but altogether 50 hours are taken up by the course. The student flies in six and nine-plane formations, perfecting himself in this work until the Squadron Commander considers the class sufficiently advanced to learn cross-over and Taylor turns—maneuvers which require exact timing and precise execution. Many students are dropped from the course at this point, for unless each pilot is perfect, the safety of the whole section is endangered. The pilots who remain must have full confidence in themselves and each other; team work is essential for fighters.

Work on tactical formations is alternated with periods of advanced aerobatics and practice dives on small parachutes that are dropped over the side of more than 6,000 feet and "fought" nearly to the ground. The student "attacks," individually and as the member of a section, planes which represent hostile observation and fighting planes. As the course nears its end, and the nine-plane formation begins to be a thing of beauty, the student's pride in his work is manifest. There are no words that can describe the thrill he receives as "his" formation changes from a perfect Vee to a perfect "line" and he sees eight other graceful fighters moving as one with him—he is on the silver side of the clouds, and the earth looks very small indeed.

Gunnery practice in Hawks requires about ten-hour's flying time, and planes equipped with two fixed machine guns are used. The student learns to calibrate his own ammunition—a job that no fighting-pilot trusts to anyone since his success and life depend on his guns. Each student fires nearly 3,000 rounds, at a target sleeve towed by another Hawk. The student learns to bomb by diving almost vertically on a ground target and releasing his bomb just before pulling out of the dive.

But the nearest approach to real combat, is experienced by the student in camera-gun practice. Hawks, equipped with cameras loaded with about ninety exposures of film are used in this phase. Sighting is done through the regular machine-gun sight; but when the bowend control attached to the stick is pulled, instead of a stream of bullets issuing forth, the camera clicks off pictures of whatever is seen on the crosswires of the sight.

Two students climb to about 12,000 feet, and dog-fight, each trying to get as many picture "hits" of the other as

[*Continued on page 62*]

A BIOGRAPHICAL SKETCH —Igor Ivan Sikorsky

by Norman F. Dacey

AWAY back in 1910, about all that the average American knew about the Russians was that they wore funny fur hats because it was so cold, they had a czar who sent them to Siberia if he didn't like their looks, and they drank vodka and rode in droschkas, or perhaps they drank droschka and rode in vodkas. It didn't seem very important, anyhow.

It would have been hard to persuade an American citizen that at that time there was a young Russian boy of twenty, with an enviable technical college training, who was beginning to build flying machines. And the Russian youth who had been experimenting with helicopters for two years was Igor Ivan Sikorsky.

As far back as 1908, Sikorsky built a helicopter; in 1910, he built one which lifted itself from the ground. And then he built the S-1, powered with a 15-horsepower motor which flew the ship. Followed the S-2 which flew 600 feet with its 25-horsepower, and the S-3, which flew 59 seconds with 40-horsepower to hold it aloft.

What happened to them when these first S ships got through flying is difficult to find out. They flew—and then young Sikorsky built another one!

Sikorsky is always described as a man of vision, a dreamer. Reading between the lines of this account of his early activities, it is evident that he was resourceful, courageous and determined.

Where did he get the money to build airplanes in those years when nobody believed that man would ever fly and that a flying machine was just the insane visualization of a demented mind? How did he have the nerve to take off in the thing when he got it built? How did he have the patience to go on after the little S ships crashed and crashed?

As a matter of fact, Sikorsky did get a little impatient after the first few crack-ups, and he began to wonder if there wasn't more to the business of actually flying than he had at first imagined. Perhaps the ships themselves were all right; perhaps they crashed because he didn't know how to maneuver them well enough. Perhaps—he decided—he'd better find out how the people who made a business of flying actually did their stuff.

So he hied him to an airport (yes, they had airports in Russia in 1911), and watched. Then he went back and taught himself to fly. So successful was he, that to this day, no one has ever been able to teach him the newer, modern methods. At that time the control wires were arranged exactly opposite to what they are now.

If you wanted to make a right bank, you used the right pedal; left bank, left pedal. Nowadays, it is exactly the reverse. But today, if Mr. Sikorsky wishes to take a plane, it is necessary for the mechanics to reverse the control wires for Mr. Sikorsky learned to fly that way and can fly no other. Anyhow, he maintains the old system was just as good, if not better.

In 1911, the S-4 attained a height of 1,500 feet and stayed there a full hour. Business began to look up. It became obvious to everyone that this young Sikorsky had an idea and an idea which could be made to work. It turned out that he had other ideas as well—ideas about multi-motored ships and seaplanes and all sorts of things that no one had ever tried.

So impressed were his confreres that the Russo-Baltic railroad car works decided to stand back of him and see what this young designer, plus unlimited capital, could do.

At the end of two years, the new multi-motored ship was completed. Four 100-horsepower engines and a roomy cabin were among the notable features. It made 50 successful flights with Sikorsky at the controls.

Many things happened in Europe in the year 1914. Among other things, it marked the construction of the first multi-motored seaplane. It shattered all world records for distance, lifting, endurance and altitude. Rather an impressive achievement for a chap of 26.

From then on Sikorsky no longer had the backing of the Russo-Baltic company. He did have, however, the backing of the Imperial Russian government whose resources were fully as great and whose interest in aviation was even greater. They commissioned Sikorsky to build them 73 big, multi-motored bombing planes for immediate war service. Only one of the lot was lost.

With the Russian revolution, Sikorsky's triumph came to an abrupt end. The distinguished and wealthy young designer, feted and lionized by royalty, became a penniless emigre to France. His indomitable courage—the same courage that carried him undiscouraged through years of nerve-wracking experimentation—stayed with him.

His only thought was of beginning again. He had barely begun laying out plans for new planes when the Armistice came. The Allies had planned to use as many as he could turn out. But the Armistice wrote "finis" to Sikorsky's work just as surely as the Russian revolution had done before.

Where to go? America, the land of opportunity. America, the rich. America, the place where so many pioneers

in the fields of science and inventions seem to have gathered. In 1919, Sikorsky came to America.

Picture him. He had no money. He spoke little English. He came, though, with bright hopes that America would want to forge ahead in aviation, so little developed here but so definitely proven necessary by war experiences.

Picture America in 1919. The Armistice. Ships, guns, supplies piled up and no market. Thousands turned out of work by the closing of war factories. The American doughboys home looking for jobs. Too much of everything but money and work and not enough of these to go around.

Arrives a young Russian who wants to build an airplane which will cost somewhere in the neighborhood of $100,000. If the Revolution and the Armistice were tragedies to Sikorsky, how much worse must have been his arrival in America!

How he got on during the next few years, he seldom describes. He had a remarkable knowledge of astronomy and an unusual grounding in mathematics and among other things, after his English improved, he picked up a little by lecturing. They were years of hardship and discouragement.

About that time, 1923, Mr. Bary enters the picture—W. A. Bary, who is now vice-president and general manager of the Sikorsky Aviation Corporation. Mr. Bary had had a successful manufacturing business in Russia, had come to the United States because of the Revolution and had begun a little business in downtown New York City.

Gradually, drawn by common interests, there had come together in his shipping room a little group of Russian naval officers, first six, then eight, and finally, twelve. These young Russians had been together at the naval college, they had fought side by side in the civil war and they knew what it meant to experience hardship. They knew what it was to stick together. Of these, two were flyers and one was a draughtsman. The latter was the only professional man besides Sikorsky, who ran across them and joined their little group.

This little, tightly-knit Russian group pooled their resources and found that they had $600. They began work with an old draughting table in the back of Bary's packing room.

Here was laid the foundation for what is today the Sikorsky Aviation Corporation. Naturally, it was impossible to build a plane with a 100-foot wingspread in the back of Bary's packing room. Sikorsky suggested that they transfer their activities to a little farm which he had purchased down at Roosevelt, L. I. They looked the place over and decided that the place to build the new plane was in the chicken-coop. And there it was built.

As the plane neared completion, the coop had to be extended here and there to cover a new portion of the wing which had just been added or to allow for this or that addition. I was necessary to disassemble the coop to get it out and it came forth like a chicken bursting from its shell covering.

The result was the S-29, a tremendous success. It carried 14 passengers and once took two grand pianos from New York to Washington. Governor Trumbull of Connecticut spoke over the radio from the cabin of the S-29, the first time anyone had ever broadcasted from a plane. It visited every state in the Union. It flew more than 500,000 miles and was finally crashed intentionally in a movie thriller. Its history is epic.

The year 1927, saw the construction of the first multi-motored amphibian, the forerunner of the S-38, which has been turned out in large quantities during the past two years. The company has become one of the leaders in the field of aviation in America.

THE INVESTOR

With aviation stocks changing position rapidly in an industry complicated by swift growths and rapid amalgamations, the opportunities for both wise and unwise investment are large. It is only on the basis of accurate and newest information that proper judgment of value may be achieved.

In order to service those readers who are interested in investment possibilities AERONAUTICS will secure the best available information on all current investment possibilities on request. Queries should be addressed to *Aeronautics Advisory Investment Service.*

"What," Mr. Bary was asked, "does Mr. Sikorsky like to do best?"

"Oh, fly, of course," he replied. "But we do not let him. We put every difficulty in his way. He is too valuable; we need him all the time for other things."

Isn't that the irony of fate? After all these trials and tribulations, the thing that he wants most to do, to fly the gigantic ships which he creates, is denied him.

"Vice-president in charge of all engineering activities" is Mr. Sikorsky's present title in the corporation. He is never so happy as when looking over someone's shoulder at blue prints and telling them what changes to make.

He would like to design new planes as often as it is practicable. For a designer, the test flight is the big thrill. Production on a large scale interests him not at all.

Igor Ivan Sikorsky now lives in a modest little white house in Stratford, Conn., only a short distance from the huge new aircraft works which bears his name. He takes an inordinate interest in his wife and small children. He is, among other things, a remarkable pianist. If he had time, he would like to contiue his study of astronomy. He is punctiliously polite and very absent-minded.

He cannot be induced to part with an old, greasy checkered cap which he wears in the factory and out. Except for flying, he does as he pleases.

His factory employs hundreds of people, the vast majority of whom are Russians who, like himself, have known the terrors of revolutionary days in the homeland. They have their own little church, and workers and company executives alike attend worship there.

On Dec. 14, the Grand Duchess Kira of Russia, great-granddaughter of Queen Victoria and youngest daughter of Grand Duke Cyril of Russia, inspected the factory.

"I am naturally quite proud," she said "to think that some of my countrymen have built such a wonderful organization."

Russians, employed in the mechanical, and woodworking departments, some of whom held high social and military positions in Russia, expressed real enthusiasm and affection upon seeing her.

Today, at forty, Igor Ivan Sikorsky, looking back over the years he spent fighting hard against adversity, has the satisfaction of seeing his dreams come true. But, being an inventor, he has no real satisfaction. His only answer is to visualize greater and more unbelievable things for the future.

THE PROBLEM OF THE SMALL TOWN AIRPORT

by A. H. Beardsley

FOR the past two or three years I have been rather closely studying the problem of the small-town airport. My home town is situated in northern New England where hills and mountains predominate, and a piece of level ground is the exception to the rule. As chairman of the aviation committee of the local chamber of commerce I have had occasion to come into close contact with aviation problems which not only confront my town but, I believe towns in other parts of our country as well. In northern New England the problem of establishing landingfields or airports seems to rest on two questions which must first be answered before an airport can be made a paying investment—is there level ground and is the airmindedness of the townspeople keen enough for the venture?

Perhaps the best way for me to present some facts with regard to establishing an airport in a small town is for me to draw from my own experience in my own home town. Our permanent population is about twenty-five hundred; but in the summer months it increases to possibly twice that number. There is no great wealth among the permanent residents, although there are many who are in comfortable circumstances.

At one of the meetings of the chamber of commerce the question of a landing field was raised. As a result, a committee was appointed of which I was made chairman—not because of my aeronautical knowledge, but because I was sincerely eager to see my hometown take its place with other communities in supplying proper landing facilities for aircraft. And then the committe on aviation began to learn something about small-town airports.

Obviously, the first thing to do was to see what we had in the way of a field of the proper dimensions, free of obstructions and reasonably near the town. There are towns in New England which have considerable areas of flat ground near them; but the majority of them are in rolling or hilly country. Some are situated in valleys between mountains. Leaving out the question of objections on the part of property owners, which might bar a good piece of ground from being turned into a landing field, I believe that to find a field that is level and of the required size is virtually impossible in most New England towns. Very true a field can be made in many places; but I refer to finding a reasonably level piece of ground which would require small outlay of labor to make over into a satisfactory landing field or airport.

No sooner did it become known that the chamber of commerce had appointed an aviation committee than we were invited to view many properties which their owners sincerely believed to be adapted to the requirements of a modern landing field. Most of these owners seemed to have the idea that an airplane lands in the same manner as a bird. That is, almost vertically. It became well nigh impossible to convince these good people that the landing speed of airplanes was between 60 and 70 miles an hour, even when they were slowed up; and that when they touched the ground at this speed, stones and tree-trunks in a pasture were virtually certain destruction to the airplane and its pilot. After all, how could these well-meaning people understand—practically none of them had ever been up, or even seen a ship at close quarters.

One of my duties as chairman was to visit every field in town which held out any hope of being developed into a satisfactory landing field. For the most part, property owners were very much interested and offered very favorable terms; but unfortunately, most of their properties were totally unsuited for aviation purposes. Time and again, some one would telephone me or call to see me with regard to an aviation field; and after I had asked a few questions, based on the Department of Commerce specifications, he or she would assure me that I need look no further. Much encouraged, I would arrange to see the property; but almost invariably I found that the size of the field had been overestimated or its grade was too steep or it was filled with stones or it faced the wrong way for the prevailing winds or it had several other things fundamentally wrong with it.

By way of example, one good soul who wished to do his bit for aviation, invited me to inspect his property which he assured me was just what I wanted. When we arrived to look it over, I found a gently rising hillside covered with second growth timber! It took considerable patience and illustration to make it clear to my well-meaning friend that his property, even at an outlay of several thousands of dollars, could never be made into an airport. Another individual offered his property without charge for aviation purposes; but it was situated on the crest of a hill which sloped down on all sides and there was not more than a hundred feet of really level ground on it anywhere. Furthermore, the road which led up to it was so steep that most automobiles could not make it, even in low gear. And, yet, this man was absolutely sincere in believing that he had a good landing field.

After chasing many of these will-o'-wisp landing fields, I finally found three properties which to the committee seemed to possess possibilities, although not one of them was fit for aviation purposes without some outlay of money and labor. At this point, I felt that I was getting in over my depth, and I asked assistance from the Department of Commerce. Let me record here that I received every possible courtesy and within a short time after my request, an aeronautical expert arrived from Washington, D. C., to look over such properties as we thought might be made into landing fields. I spent the greater part of a day with the representative of the Department of Commerce who made a thorough inspection of the three fields which seemed to us to have possibilities.

At the end of his inspection, the expert gave me his advice, and it was all confined to one property. The other two he promptly disproved for aviation purposes. With regard to the property

[*Continued on page 60*]

THE NEW MODE

Above, Betty Huyler, member of the Long Island Aviation Country Club, in her white suede pilot outfit with helmet to match. Left, Frances Harrell loses none of her charm in her practical leather jacket and sports breeches. Below, Fay Gillis displays her own creation, a blue leather flying suit lined with camel's hair.

These three young women, all experienced pilots, are members of the "99" club. The styles they sponsor are based on a knowledge of the requirements of actual flying.

WHY WOMEN PILOTS HAVE ORGANIZED

The formation of the "99" club is a tribute to the growing strength of women's activities in aviation. Miss Brown, a charter member, gives an interesting insight into the *raison d'etre*.

by Margery Brown

"THE women pilots are organizing," a newspaper man remarked ironically in print. "We don't know what for!"

This is to tell the world "what for!"

Women pilots are organizing to abolish sex from the skies.

When a lone woman sets forth with the steely glint of determination in her eyes, and the avowed purpose of bringing a certain thing to pass, there is only one result—that thing will come to pass! Even men admit it. Woman's persistence, perseverance, stick-to-it-iveness (call it what you will) is too well known to require defense.

Consider what it means for all the women pilots of the country to set forth with the glint of determination in their eyes and an avowed purpose; the while their number steadily increases, and their strength steadily grows. There can be only one result.

A good many months ago I wrote to Lady Heath, "There ought to be a place where women pilots can get together and express their ideas freely," or words to that effect.

Did we newer pilots realize that she and the other pioneers, had been blazing the way for us, I wondered?

And there stirred in my consciousness the first faint signs of an awakening sex loyalty, which had been soundly sleeping all these years; and which probably would have continued sleeping soundly, but for aviation.

There is something about flying that inspires sex loyalty in women. Since this organization has been in the process of formation, the fact has become clearer and clearer. Not in an isolated case here and there, but in women everywhere, flying arouses an earnest desire to cast aside the littleness, the pettiness of the personal viewpoint, for the larger one of cooperation.

Flying is teaching women that they can "stick together."

Oddly enough, a man is indirectly responsible for the fact that women organized when they did.

He said in a pleasantly conversational way on the field, "You women pilots ought to organize!"

At once I realized it was exactly what was needed.

I went to Miss Trenckmann with the idea. Although not a flyer, she was obviously in a position to send out the first call, for, as head of the Woman's Department of Curtiss Flying Service, she was mailing a weekly news letter to every licensed woman pilot in the country. However, we agreed that the club, once formed, was to be cut free from any commercial organization.

Three other pilots—Neva Paris, Frances Harrell and Fay Gillis—expressed their willingness to sign the mimeographed letters with me. We got the letters into the mail in a week's time.

Enthusiastic replies came from all parts of the country. Phoebe Omlie wrote in to say that at the Cleveland races, the possibility of such an organization had been discussed. The idea wasn't a new one, after all. But, we had started the ball rolling!

It rolled on merrily to the "get together" meeting, which took place at Valley Stream in November, with an attendance of 26. The din and clamor in the hangar prevented serious business being discussed. The business of getting really organized was neces-

Left to right: Neva Paris, Mary Alexander, Betty Huyler, Opal Kunz, Jean Hoyt, Mrs. Keith Miller, Amelia Earhart, Marjorie May Lesser, Sylvia Nelson, Dorothy Leh, Margaret O'Mara, Margery Brown, Mary Goodrich, Irene Chassey, Olivia Mathews, Ruth Webb, Fay Gillis; Front row: Viola Gentry, Mrs. Kenyon, Wilma Walsh, Frances Harrell and Meta Rothholz.

sarily postponed until the December meeting.

Dozens of the girls who couldn't get to Valley Stream, came by telegraph, telephone or letter. Amelia Earhart and Ruth Nichols were among the transport pilots who attended in person. Viola Gentry, out of the hospital that day, came on crutches.

Marjorie Stinson wrote, "Such a club as you four enterprising young ladies have outlined, should do unlimited good for the industry at large. I hope it will be possible for me to be among those present at the next 'Halo Polishing of the Angel's Club.'" And she added, breath-takingly, amusingly and rather surprisingly—until one remembered that she was flying when the rest of us didn't even know that airplanes existed—"I am most interested to know the views of the newer pilots —those who have learned to fly during the last five or ten years!"

Bobby Trout applauded, "The idea is a very good one, and more power to it!"

From Madeleine Kelly came good wishes and the hope that we would "'.ave a tail wind at all altitudes and many happy landings."

Ruth Bridwell wrote, "Congratulations on the steps you have taken to organize the pilots of the weaker (?) sex. My hat and helmet is off, in recognition of your fine spirit. I had planned to slip in at Valley Stream, but due to injuries I received in a crash (no, I wasn't *at controls*, an 'experienced male pilot' was) I'll be patting arnica gently on bruised 'funny bones' instead." She went on, "I know you girls will put the organization over like a skyrocket, and I'm betting everything but my tooth brush that you do."

Since that first get-together meeting, increasingly interesting views have come by mail from members. "Friendliness, sex loyalty, cooperation" is the chosen motto. Not everyone for herself, but each one for all. Women are becoming inspired, as a class, with the desire to help the other woman.

With this splendidly disinterested spirit as its mainspring, the organization is bound to succeed in its purpose.

But what, one may ask, has all of this to do with the abolishing of sex from the skies?

Let me quote Opal Kunz:

"I have found that, with regard to racing, many men object to the idea of allowing women to compete. The main reason seems to be that they expect women to request special handicaps or favors. If girls want to race with men, they must learn to do it on exactly the same basis as the men themselves, asking no odds in the line-up or handicaps. I feel sure that as fast as we demonstrate our ability and our fair play, discriminations will disappear. But we have yet to prove our worth on a large scale."

From top to bottom, Ruth Nichols, transport pilot; Mrs. Keith Miller, piloting a Fairchild in Ford Tour; Amelia Earhart (left), trans-Atlantic flyer, and Blanche Noyes (right), transport pilot—all members of the "99" club.

Women cannot demonstrate fair play, they cannot go into the skies on exactly the same basis as the men, until sex has been abolished from aviation!

And the women who have organized, agree, one and all, that they want no discriminations made between the sexes. Not only in the matter of races, but in every branch of aviation, they want to be on absolutely equal terms with men. They prefer to "take the bitter with the sweet;" they want no special consideration because they are women; in the last analysis, they aspire to banish sex completely from the heavens!

The name of this national organization is the "99" Club.

At Amelia Earhart's suggestion, we adopted the number of charter members as the Club's name.

This is the only national organization of women pilots in the world. Only flyers licensed by the Department of Commerce are eligible for membership, and loss of license automatically drops one from the roster.

All licensed women pilots in good standing, are eligible. Since we organized, many new members have been added, and nearly all of the licensed women pilots in the country belong.

Where women are concerned, there is far more to flying than just the physical action. It holds wonderful possibilities in the development of qualities that women need. It is freely admitted by women now, that in many cases they seem to lack these qualities. In that admittance lies their hope and their salvation. Recognizing what they need, they are going to acquire it.

They are only at the beginning of the metamorphosis which they see is so essential. Attaining their end, means far more to most of them than does masculine admiration or approbation—or censure, for that matter. The fact that women are bent on abolishing sex from the skies, is actually bothering men considerably more than it is bothering women. The latter have their eyes fixed on something beyond mere sex; something, possibly, which men have always had in a measure, and which women are now resolved to get!

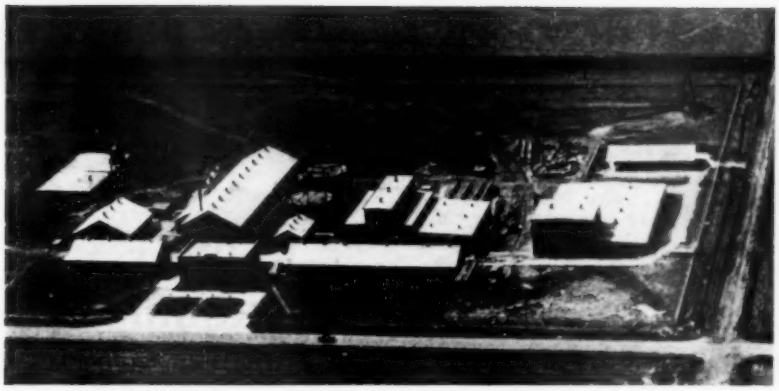
They have the glint of determination in their eyes, and an avowed purpose. Moving forward, their number steadily increases and their strength steadily grows.

And they are moving forward as one body!

Women have organized.

XUM

The helium plant at Amarillo.



Helium Production

by H. C. Upshaw

HELIUM for inflation of the nation's dirigibles is now being produced at Amarillo, Texas.

With the eyes of the nation turning to the heavens where giant silver ships glide by, the thoughts of the nation are turning to a consideration of the safety of the ships' crews and the commercial success of aerial navigation. Helium, a non-explosive gas, is the greatest factor contributing to the safety and success of the dirigible at this time.

Helium was discovered long before the dirigible was invented, but it held little commercial importance until the demand for a non-explosive gas for inflation of lighter-than-air craft inspired its practical application to this need. Then for many years the problem of producing this rare gas in sufficient quantities for this purpose and its prohibitive cost precluded its use. Scientists have solved the problem of cost and the gas fields of the Texas Panhandle, carrying a high helium content, solve the problem of quantity.

In 1868, an English scientist, Joseph N. Lockyer, looking at a total eclipse of the sun through a spectroscope, observed an element not known to science. He called it helium (symbol He) from Helius, the Greek word for sun. Just as the germ theory in medical science was impossible of conception before the invention of the microscope, so helium could not have been discovered at this time without the use of the spectroscope.

An American scientist, Hildebrand, later released helium by heating radio-active minerals, the first time helium was found on earth. However, he failed to identify the gas as helium and so his experiment was of little value to science. Sir William Ramsay, an English scientist the discoverer of argon and other atmospheric gases, neon, krypton and xenon, found and identified helium in the air we breathe, in parts one to 180,000.

Until Ramsay's discovery helium was known only in the sun's rays. But an interesting fact about helium is that scientists were able from the first to predict what it would be. They knew before it was found on earth that it would be a gas, light, odorless, colorless, tasteless, inert and non-combustible. After it was discovered in atmosphere, helium was easily identified and was obtained from heated radio-active minerals. Scientists began to collect it, to experiment with it, to speculate as to its possible uses in the commercial world.

Until the year 1903, radio-active minerals were the only source of this rare gas. In 1900, natural gas had been found and was popular for use as fuel. At this time an oil well was being drilled at Dexter, Kan., and in 1903 it came in with a strong flow of gas. The people in their enthusiasm, planned a big celebration. Plans were completed to divert a small amount of the gas through a pipe for a torch light. The people gathered for the celebration, and a big bonfire was lighted. Then the gas was turned into the pipe for light.

[*Continued on page 74*]

A portable helium purifier used at the Goodyear-Zeppelin airship factory at Akron.

XUM

Aeronautic Law

by Bailey Samelow

Member of the Chicago Bar

THE question of liability in accidents due to or in the case of aeroplanes presents a complicated problem. The complications arise from the fact that such cases involve new elements, new considerations or new conditions—which before did not enter into like legal circumstances.

Let it be remembered that the domain we now have in mind is the air. Before the air claimed attention from jurists, the two domains lawyers and judges faced were the seas and the land. The seas have laws which we call maritime laws. The land has laws which we call land laws. Now we have to formulate or adopt laws which we, at least for the present, call aeronautic laws.

As indicated in a former paragraph, conditions which arise in situations in the air are frequently different from those which in like legal cases arise on land or on the seas. Therein lie the problems that confront the lawyer or the jurist when he begins to interpret an act in the light of the law.

For instance, two autos collide. Both drivers are found to have been equally negligent. The land law accordingly dismisses the case as a case where the law cannot aid either. The decision is the same whether both cars are of equal value or whether one car is more expensive than the other, or whether the damages sustained by each owner are equal or of different amounts. The theory is that both are equally responsible for the accident and each accordingly is to bear the damage which his negligence has created for him in confluence with the negligence of the other party.

Under maritime law, lawyers and jurists in a similar case would take into consideration the amount of damage sustained. Take a case where a $25,000 boat and a $500,000 boat collide, with the fact established that the responsibility lies equally between the two boats, and that the smaller boat has suffered a total loss of $20,000, while the bigger vessel has established a loss to cargo and craft of $30,000. According to the law, the judge would take the $10,000 difference in damages sustained, and return a verdict by which the owner of the larger craft would receive a judgment of $5,000 against the owner of the smaller craft. The theory of the law applied in this case is based on the conclusion that where the two owners are equally responsible for the cause, they should both be equally responsible for the losses sustained as a result of such joint responsibility.

This viewpoint in maritime law undoubtedly developed because of the wide difference in cost of vessels, and particularly in the difference in value of cargo. The smaller vessel of the two referred to above carried, let us say, sand out into the sea, while the larger one was loaded with silks, satins and other such valuable and perishable materials.

Now let us take a similar case in the air—say a collision between a $10,000 aeroplane and a $10,000,000 Zeppelin. The negligence, it is established, is equally traceable to both owners. The damage sustained by the Zeppelin is appraised at $50,000 while that of the aeroplane is found to be the maximum of $10,000. We will assume, for the purpose of simplicity, that in all the cases cited no losses were caused to life or limb.

Now which system of law shall be applied to this case—the maritime or the land law? If the land law is applied, the case is dismissed as a case without recourse for either party. The court leaves them as they were, each to bear his own loss. If the maritime law is applied, then the owner of the smaller craft would be subjected to a payment of half the difference between $10,000 and $50,000—that is, the owner of the smaller craft would owe the owner of the larger craft the sum of $20,000.

Now which of the two systems of law should be applied? Are aircrafts in the same category as seacrafts or are they to be considered the same as land vehicles? Is the air medium the same as the sea or the same as land in the situation which here claims the attention of lawyer and jurist?

This shows plainly the requirement for a new set of laws. For the present a few of the states—only 11—have adopted a sort of blanket statute, which is called the Uniform State Law of Aeronautics, by which the land laws apply to such cases arising in the air. If an accident like one of the above occurs in one of the states covered by the Uniform State Law the case of course comes automatically under the well-defined land viewpoint. But if the accident happens in a state where this law has not been accepted, a judge hearing the case would be in a quandary.

A judge in such a state would naturally take cognizance of the case—that is, he would be obliged to hear it—but the decision of the judge might be questioned:

First, has the judge jurisdiction of a case for which the state provides no law? In other words, has he a right to hear the case at all?

If he has:

Second, is the decision rendered, either according to the maritime law or according to the land law, an equitable decision?

If the judge resorted neither to the maritime law nor to the land law, but ingeniously worked out a decision particularly suited to the case—suited according to his point of view—before him:

Third, has he a right to depart from law systems and apply a remedy of his own concoction, which virtually would mean that the judge has assumed partially a legislative function?

Questions and Answers

DO you know of any liability on the part of the city when the city has under its control an airport which has been acquired by the city by lease under legislative authority and the same has been in turn sublet to an aircraft company for school and other purposes?

The point of my inquiry, would there be any liability on the part of the city for any

[*Continued on page 50*]

AERIAL NAVIGATION

Maps and Mapping Part II

by
Cdr. Douglas G. Jeffrey, R. N.

IN the first part of this article, we discussed various types of maps, their projectors and scales. Before considering charts, a word or two about "squared and gridded" maps may be of use. The Manual of Air Pilotage (British Air Ministry), gives the following clear and concise notes on these two classes of maps.

"A squared map is one in which each sheet, regarded as an individual map, is by some means divided into sections which are identified by letters and numbers printed either in the margins or upon the face of the map. Each sheet may be divided into sections by the graticule (in which case the sections are not true squares) or by a system of squares specially drawn and having no relation to the graticule. In the latter case the squares, although drawn to the same scheme on the various sheets of a series, are generally wanting in common boundaries, so that one sheet cannot conveniently be joined up to another. The advantage of squaring is that the position of a point on the map can easily be found by reference to the square in which the point is known to be situated. When using squared maps, it is necessary to give as reference first the sheet number of the map and then the letter and number identifying the square. Two-inch squares are printed on the third edition ¼-inch Ordnance Survey maps."

"A gridded map must not be confused with a squared map. A map is gridded by drawing straight lines through a selected point known as the origin, one true north and south, and the other true east and west. These lines are the axes. Over the whole map (consisting, perhaps, of many sheets) are drawn lines parallel to the axis at intervals of tens, hundreds or thousands of some definite unit of length, as, for example, 1,000 metres or 1,000 yards, so that the whole map is divided into squares of sides 1,000 metres or yards. The distances of the corners of all these squares east and north of the origin will then be known precisely. To locate a point it will then be necessary merely to measure its distances east and north of the south-western corner of the square in which it lies, and to add the co-ordinates so obtained to the east and north co-ordinates of the square. The advantages of the grid are considerable. The system is independent of sheets and of the scale of the map, and it is possible to calculate very simply the distance between any two points and their relative bearing, whether the two points are on the same sheet or not."

"Suppose that squares of 1,000 metre (or 1 kilometre) sides are used, so that each grid line is a certain number of kilometres east or north of the origin. Starting from the origin, every tenth grid line is emphasized. These tenth lines form squares of 10 km. sides and each 10 km. square is given a letter. In a square of 50 km. sides there are twenty-five 10 km. squares denoted by the letters A to Z, omitting I. Each km. square is given a 2-figure number, which represents the co-ordinates of its south-west corner in kms., measured from the south-west corner of the large (10 km.) lettered square. These letters and numbers are printed on the map. Along the margin of the map are printed also numbers which represent the distance in kms. of each grid line east or north of the origin. Every tenth line has this number in full, while the intervening lines are numbered 1 to 9."

"Consider square 5, 3 (shaded in Figs. 1 and 2): this is shown on a larger scale in Fig. 2. Suppose the co-ordinates of a point P in this square are 4, 6 measured by taking tenths of each side east and north. Since a tenth of a kilometre is 100 metres, this means that P is 400 metres east of 600 metres north of the south-west corner of square 5, 3. Now the number 53 means that the south-west corner of the km. square is 5 kms. east and 3 kms. north of the south-west corner of the 10 km. square. Then the co-ordinates of P in the 10 km. square are 5,400 metres east and 3,600 metres north. The map reference of P is given as A5436. If it is required to locate P more accurately, hundredths of the side of the square 5, 3 may be taken instead of tenths, and then six-figure co-ordinates are used. Thus the map reference might be A541362. Four-figure co-ordinates describe a point to the nearest 100 metres, and the six-figure co-ordinates to the nearest 10 metres."

"The letter denoting a 10 km. square is adopted as a convenient abbreviation to show the position of the square without writing its full co-ordinates. Thus, Fig. 1 shows that the square A lies between 150 and 160 kms. east and 440 and 450 kms. north of the origin. Further, it means that every point in the square A has full co-ordinates which begin with 15 and 44. Square letters are repeated at every 50 kms. Thus, the next square named A lying to the north is situated between co-ordinates 490 and 500 north (with the same easterly co-ordinates), and all points within the square have full co-ordinates beginning with 15 and 49."

"It may often happen that there can be no doubt as to the 10 km. square in which a point lies, in which case it would not be necessary to give the letter of the 10 km. square. If, however, there is any chance of a square being mistaken for another, 10 kms. away, the correct letter must precede the reference."

"The map reference of a point can be given by two, four, six or even more figures, depending upon the accuracy with which it is wished to locate it."

"The R.A.F. special edition of the quarter-inch Ordnance Survey map is shortly to be gridded. The map of the British Isles and Northern Europe will be covered

XUM

with a grid consisting of squares of 250 kilometres side. Each large square will contain 25 squares of 50 kilometres side and the smaller squares will be further divided into 25 squares having sides of 10 kilometres. Letters will be given to every square, so that the 10 kilometre squares will always be distinguished by a three-letter reference."

"In using squared and gridded maps, the lines must *not* be mistaken for meridians, when laying off courses, etc."

Charts

In practically all *charts* used by airmen or on Mercator's Projector and for general navigation, it is very convenient that a rhumb line (which is the course of an aircraft steering a constant course in a calm) should be represented by a straight line. The meridians on a Mercator chart, as explained in Part I of this article (February issue), are drawn as parallel straight lines at right angles to the equator. The equator, being a rhumb line, is represented by a straight line on the chart and all parallels of latitude appear as straight lines parallel to the equator, and at right angles to the meridian.

Charts are generally graduated on the left and right hand edges for latitude, and at top and bottom for longitude.

It is important that the novice remember that the divisions of the longitude scale are only to be used for laying down and reading off the longitude of a place, and on no account must they be used for measuring distance. Since Projection 1′ of latitude always equals one nautical mile, the latitude scale is used for measuring distance.

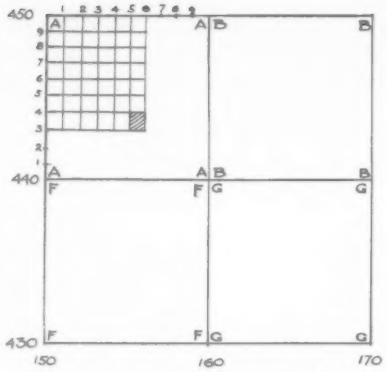


Fig. 1—Map grid—system of lettering.

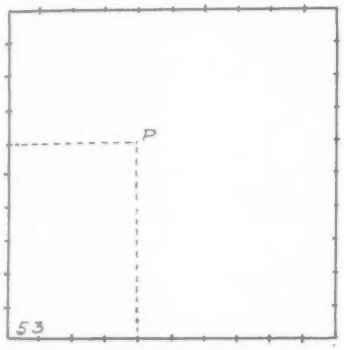


Fig. 2—Map grid—Co-ordinates.

Map and Chart Reading

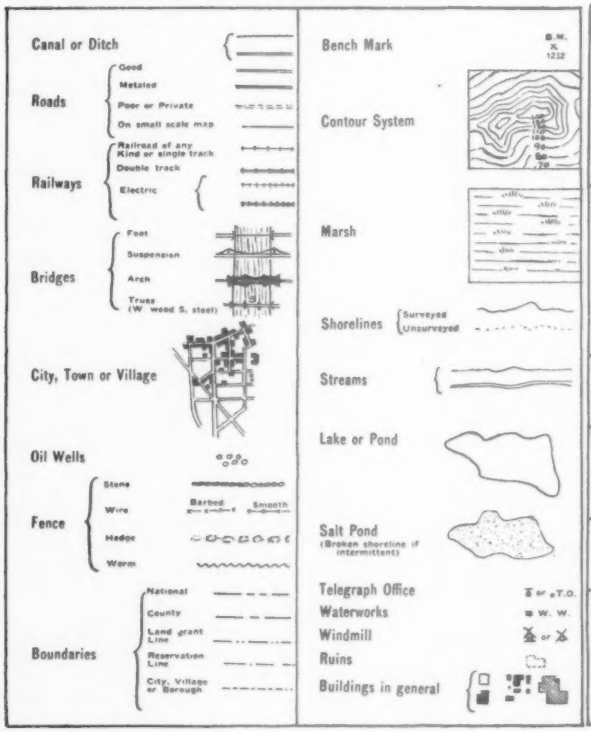
Facility in reading from a map all the information that is contained in the conventional signs, etc., that may be employed, is an accomplishment that can only be attained by constant practice.

The term "map reading" means to the soldier or airman, the art of interpreting the topographical features of general appearance of a portion of the earth's surface by the examination of a map, whereas the ability to "read a chart" means to the sailor little more than a clear understanding of all the conventional signs used upon the chart. The airman should be conversant with both map and chart and *their use from the air.*

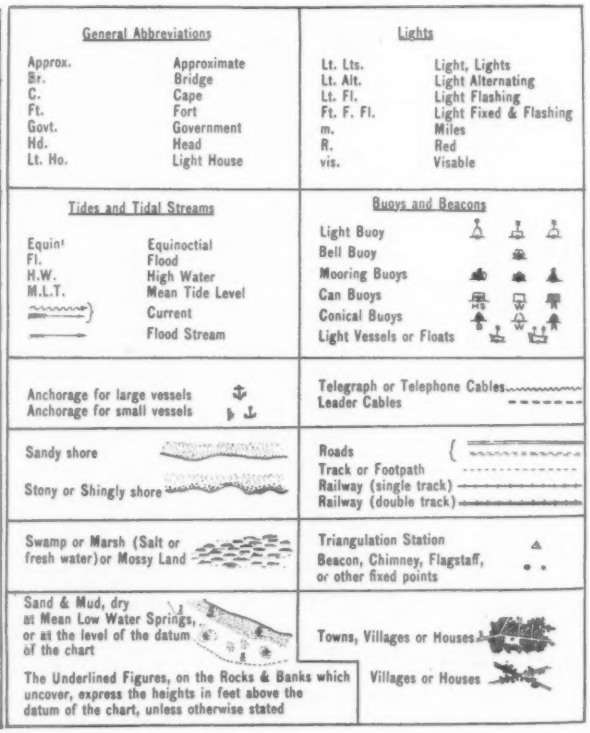
This special knowledge of maps and charts implies the ability to recognize features below, while moving at high speeds and varying altitudes. Aerial maps are daily becoming more efficient and satisfactory, but there are still vast portions of the earth's surface including a considerable portion of the United States that are not covered by airway maps.

[*Continued on page 48*]

Common conventional signs, maps.



Common conventional signs, charts.



Alexander Klemin
Professor of Aerodynamics, College of Engineering, New York University

Article 17

Handley Page Slot and other Devices to Increase Wing Lift

AERODYNAMICS

AS we have stated previously in these articles an important problem in modern aviation is to decrease the landing speed, length of landing run, and length of get-away run. These objectives are closely allied and constituted the main purposes of the Guggenheim Safe Aircraft Competition.

If the maximum lift coefficient of a wing is increased, the minimum flying speed is decreased for a given area and gross load, because V landing $= \sqrt{\frac{W}{k_y \text{ max. Aar ea.}}}$

If the minimum air speed is decreased, then the length of landing run is decreased also, because the airplane has less kinetic energy on landing. Again if the minimum flying speed is less, a shorter run on the ground is required before the airplane gets into the air.

Improvement in all three characteristics, without sacrifice of other good qualities of the airplane, is thus seen to depend mainly on increase in the maximum lift coefficient of the wing.

The maximum lift coefficient of wings as used in practice today rarely exceeds .0036. Wings have been designed and tested in wind tunnels which have maximum lift coefficients of over .0040, in two cases as high as .00456. But such wings of excessively high lift, have also very high drag and poor lift/drag, and are entirely unsuitable for general use.

It does not seem promising therefore to seek wings of very high lift, but rather to use devices which will increase the lift of the wing when required (that is on landing or take-off) but which will not increase the drag of the wing in normal flight.

It is the purpose of this article to review briefly what has been attempted thus far along these lines.

Monoplane Converted into Biplane

The arrangement shown in Fig. 1, has been tested in the wind tunnel at Göttingen University. With the upper wing brought down to fit over the lower wing, the combination gave a conventional wing of good efficiency. With the two surfaces opened up, a maximum ky of .00605 was obtained, nearly twice the normal value. The conversion of a monoplane into a biplane is also being developed by some competent engineers in the United States. Aerodynamically the idea is promising, but its mechanical execution is not so easy.

Fig. 1. Monoplane converted into a biplane at slow speeds.

R. H. Hall of the Cunningham-Hall Aircraft Corporation has also worked on the conversion of a monoplane into a biplane, but on a different principle. The device is illustrated in Fig. 2. The opening of the front flap and the depression of the rear flap gives the equivalent of a biplane of very small gap.

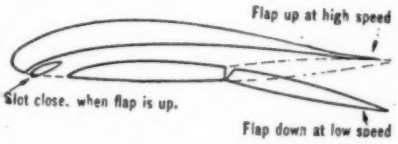


Fig. 2. Cunningham-Hall variable lift device.

The tunnel tests showed very high increases in maximum ky values. A machine embodying this device was presented at the Guggenheim Safe Aircraft Competition and the mechanical functioning of the device presented no difficulty, although owing to insufficient lateral control it was found impossible to test the aircraft at the high angle of incidence necessary to develop its full lift value.

Variable Camber

Quite a number of men have worked on the idea of varying the camber. At high speeds the wing is to be of low camber, high speed profile; at landing it is to be converted into a high lift wing. The Parker and the Burtenbach Variable Camber wings are illustrated in Figs. 3 and 4. The objections to such devices are that the increase in lift possible when varying the camber is only moderate. If the camber is increased beyond a certain point, the wing no longer maintains its streamline contour and the increase in lift which might be anticipated is not realized. In view of the small effects produced and the mechanical complication involved, it may safely be said that variable camber wings are not promising.

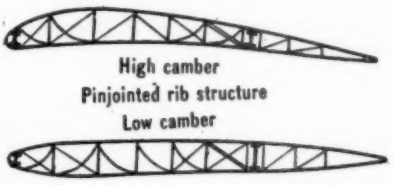


Fig. 3. Parker variable camber wing.

Variable Area and Camber

A number of machines have been flown, in which both the area and the camber have been changed simultaneously. The principles involved are illustrated in Figs. 5, 6, and 7. In the Gastambide-Levasseur airplane, built and flown in France, a fixed lower wing was combined with a variable area upper wing, the movable portion of the upper wing pivoting about a hinge fastened in the lower wing. Reports state that quite an appreciable improvement in speed range was obtained.

Fig. 4. Burtenback's variable camber wing.

The principle of Harlan D. Fowler's variable area and camber wing is clear from our sketch. Both in the wind tunnel and in application to Curtiss JN, the device showed considerable improvement in maximum lift.

At the Guggenheim Safe Aircraft Competition, Burnelli presented a machine in which the rear part of the wing slid back and down, the front part, forwards and down. This in the

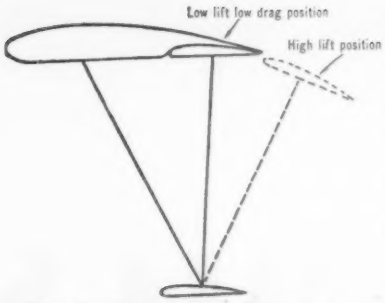


Fig. 5—Gastambide-Lavasseur variable camber and area arrangement.

wind tunnel also gave an appreciable increase in lift.

There is no doubt that the combination of variable camber and area can be made to give an increase in lift of some 70 per cent over the basic wing. It remains to be seen, however, whether the principle will be embodied in practice because of the mechanical complications involved.

Variable Incidence

We will only mention the use of variable angle of incidence to warn of its futility as a means of increasing lift. No matter what angle of incidence a wing may be set to the thrust line or other fixed line of the airplane, its maximum lift coefficient cannot be increased by such variation in setting. Therefore variable incidence can have no effect on the landing speed. It may have some theoretical advantages in climb and in landing run but these are too insignificant to be worth the trouble involved.

Flaps

A great many experiments have been tried with hinged flaps, which are exactly like ailerons, but running along the whole length of the wing. When flaps are applied to very thin wings, there can be as much as 50 per cent increase in maximum lift, but the final value of the maximum lift is only about .00375. When the flap is applied to wings of medium thickness it is only possible to obtain some 30 per cent increase, and when applied to high camber wings, the increase is only of the order of some 25 per cent.

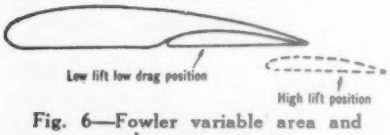


Fig. 6—Fowler variable area and camber arrangement.

The application of a rear flap is perfectly simple, and is certainly helpful. By the Fairey device shown in Fig. 8, the rear flap can be made automatic. The spring always tends to push the flap down, but at low angles of incidence the pressure is concentrated towards the rear of the wing and overcomes the action of the spring. So, at high angles, the flap is down and gives us higher lift; at low angles of incidence the wing automatically assumes the contour suitable to high speed.

The use of the rear flap is perfectly sound and helpful; its effects are, however, not sufficiently marked to justify its general adoption.

Rotating Cylinders

In our article on airfoil theory we have seen that the lift of a wing depends on the circulation round the wing, which increases the speed above the wing and diminishes the speed below it. It has been frequently proposed that this circulation should be increased artificially by the introduction of a rotating cylinder within the wing. Different arrangements for increasing the lift in this manner are illustrated in Fig. 9.

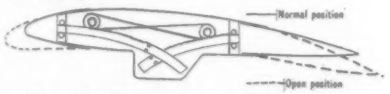


Fig. 7—Burnelli variable camber and area wing.

Very powerful increases in lift can be obtained by such devices. Nevertheless they are not likely to come into general use. If when at rest, the introduction of such devices breaks up the streamline contour of the wing and thus reduces its efficiency in normal flight. Again in order to be effective the cylinder would have to rotate in the

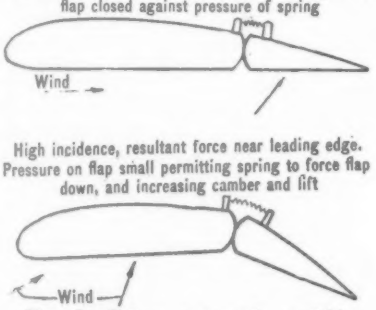

Low incidence, resultant force near tail tending to hold flap closed against pressure of spring
Wind
High incidence, resultant force near leading edge. Pressure on flap small permitting spring to force flap down, and increasing camber and lift
Wind

Fig. 8—Fairey automatic variable camber device.

air at several thousand revolutions per minute. The mechanical difficulties involved in mounting a cylinder in the wing and driving it at such high speeds are obvious. No one would seriously consider the utilization of a rotating cylinder in practice.

Control of the Boundary Layer

Another type of lift increasing device, which has not yet passed beyond the laboratory stage, is that involving boundary layer control. At the angle of incidence of maximum lift of a wing, we know that the flow tears away from the upper surface of the

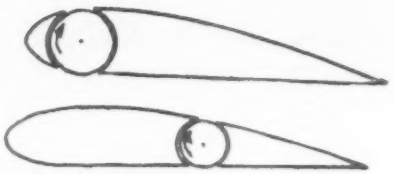


Fig. 9—Rotating cylinders in wing, increasing circulation and lift of wing.

wing and instead of being streamline, appears in the form of whirls or eddies. By applying suction to the interior of the wing as in Fig. 10, it is possible to prevent the break-down of the flow up to angles of incidence as high as 45 degrees, and to secure a lift three times as great as the normal maximum lift.

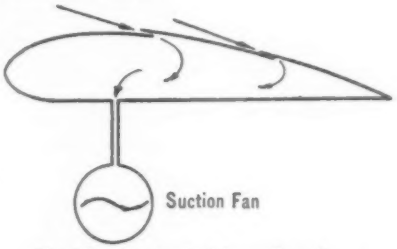


Fig. 10—Control of boundary layer by suction applied to upper surface of wing gives high lift at high angle of attack.

It is also possible to delay the burbling of the wing by ejecting air under pressure from the interior of the wing, (Fig. 11). Both these devices are theoretically promising. It remains to be seen what power such methods of control will require for the full size airplane and what the extra weight and complication are likely to be.

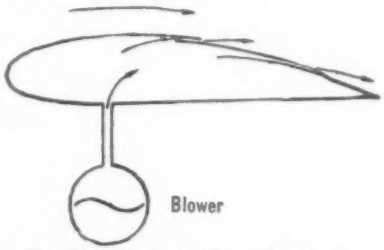


Fig. 11—Control of boundary layer by ejection of air on top of wing. Gives high lift at high angle of incidence.

The Handley Page Slot

We now come to the lift increasing device, which in combination with the use of the rear flap, is by far the most promising and most practical device yet invented, namely, the Handley Page slot.

To understand the action of the Handley Page slot, it is first of all necessary to examine again the phenomenon of "burbling" at the stall for the ordinary wing. There are two stagnation points for ordinary streamline flow

[*Continued on page 54*]

THEY TELL US-

A Forum of Comment Criticism and Remarks

New York City, Dec. 30.—The cover designed by H. Jewett for the January 1930 issue of "AERONAUTICS" has been selected to appear in the next issue, Volume 7, of "Modern Poster Annual."

Our publication, which is a collection of the year's best color designs, is circulated in public libraries, colleges, and similar institutions for publicity and educational purposes, and we make no charge for this representation.

A copy of the issue containing your insert will be mailed on publication.

A. BROWN
—MODERN POSTER ANNUAL

Shamokin, Penn., Dec. 30.—I am a collector of Air-Mail-Covers of First Flights and special flights commemorating events of note.

In November, 1929, issue on page 46, you give clippings of events under "Brief Notes For The Month."

I believe it would be of interest to collectors of Air-Mail-Covers, if you would have a page for "Philatelist Futures" thereby giving all collectors advance information of new air lines and celebrations, always endeavoring to cover future events, instead of past.

W. E. OGDEN

Dayton, Ohio, Jan. 11.—Let me say just a few words in regard to one of the comments I saw in the column "They Tell Us."

As one of the readers of your magazine who is trying to find out all he can about aerodynamics, etc., I feel that I am satisfying that wish when I buy a copy of "AERONAUTICS." So personally I would be disappointed to see the articles written by men like Mr. Klemin give away to articles of a lighter vein.

HUGH K. FUNKHOUSER

Chicago, Ill., Dec. 29.—In the December issue of AERONAUTICS I read with some interest a letter from a self acknowledged successful inventor, who decries the fact that inventors and their inventions are seldom taken seriously by manufacturers or their consulting engineers.

Contrary to his opinion, technical experts who have secured their doctor's degree are not fakes and cannot be considered as anything but highly trained men who have achieved their recognition by hard work, years of study, display of ability and good sound knowledge of their subject. It is true that some men who have not had this training have by a great show of perseverance and ambition discovered scientific phenomena that has made them famous, but these men are few and far between.

There are and always will be a great number of men who work constantly toward the solution of various problems with different purposes in view. Some will attack their problems from a purely scientific viewpoint, others by trial and error methods which may turn out successfully if continued long enough. The mere fact that our inventor has secured a patent for his invention does not necessarily mean that the invention is good; it only protects his rights as to the originality of his idea. There are registered in the patent offices today hundreds of inventions of airplanes and flying machines that disclose no sound reasoning power and whose principles of operation are so easily disclosed as impossible by the application of a little technical analyzation that we often refer to the originators of these ideas as fanatics, or if I may use the words of our inventor, "nuts with a lot of wobbly wheels in their heads."

Then, again, we often see the case where an inventor has discovered something which to all appearances will be successful and he wonders why his idea is not marketable. Most of the time these inventions, while products of good engineering, are not considered products of good economics, or they may involve some mechanical difficulty which, if corrected for, would be so expensive that the disadvantages of the idea would outweigh its advantages.

I, myself, have worked a long time on control design only to have a number of apparently good systems fail when placed under the microscope of technical possibility, economical consideration and practical application.

It would be most advantageous to inventors who think that they have found something worth while to have their theories, models etc., carefully checked and approved by a responsible practicing aeronautical engineer before trying to market their inventions. Such a procedure will save time and the inventor will avoid many future disappointments.

The old adage "a little knowledge is a dangerous thing" applies to Aeronautical Engineering as well as to other sciences.

MARVIN I. THOMAS
—AERONAUTICAL ENGINEER

Washington, D. C., Dec. 19.—We duly received your letter of November 25th and the copy of the October issue of your magazine and noted the petition contained on page 13 thereof on which you asked the Chamber's views.

As you may know action by the National Chamber on specific questions is either referendum vote of its members or actions upon resolutions at annual meetings. The particular question raised in the petition to which you refer has not been specifically considered by the Chamber, but the following quotation from a declaration of the Fourteenth Annual Meeting indicates an unfavorable attitude toward any merging of commercial with military or naval aviation as far as the government is concerned:

"Civil Aeronautics in the United States should be given full opportunity for growth through commercial development, with reasonable regulation and active promotion by federal government, and separately from the military and naval aeronautical services. * * * *"

A. T. STEWART
—CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA

AERONAUTICS presents here the informal opinions of vital men, believing that in a rapidly changing industry, these are of great value in estimating the direction aviation will take. These are selected primarily for value in thought or opinion.

Thrift, Texas, Dec. 30.—I have been reading your magazine since September, 1928, and the farther you go the better "AERONAUTICS" seems to get.

One thing that, in my opinion, would help aviation, by causing more people to become interested in flying, is a suitable plane for the man of limited means.

By suitable, I mean a plane that would have all of today's safety factors, and yet be sold at a price that a man that was below the "rich" class could afford to buy and operate.

It is not my object to find fault with aeroplane builders, nor anything like that, neither do I say that they are asking too much for their product, but I do say that what they do need is to find the way to build a plane for the majority of the people at a price that the majority can afford.

Of course there are many things that make an aeroplane cost more than an automobile, but volume production of a plane for the average man would make it possible to get the price down somewhere within the reach of thousands that cannot even consider owning a plane at present.

There is no use to say that there is no market for a low priced plane because there are too many people interested in buying a plane if they could afford it. People today are, I believe, much more airminded than they are given credit for, but if a man has to be worth ten thousand dollars to be able to afford to show his airmindedness, most will not make much fuss.

I do have a desire to own a plane, just as I own an automobile and here is how my mind runs on it: If I could own a plane I could take my family, and almost any time go to see my wife's folks about 400 miles away. At vacation time, we could go to see my own father and mother, 1,800 miles away, whom I have not been able to see for six years, because the vacation time is too short to get there and back in the car, with any pleasure at all. We could visit friends 100 or 200 miles away any Sunday as well as we now go 50 miles on the highway and I feel certain there are half a million others like me that would be glad for a plane that they could afford to own. Of course, it is coming, so why not get the suitable plane on the market at the present time.

L. P. HOFFNER

XUM

BRIEF NOTES FOR THE MONTH

A digest of the important information and developments of the month, compiled each issue for the busy executive with vital information classified and quickly accessible.

AIRPORTS

An intermediate airplane landing field will be established at Midland, Tex., by authorization of the Secretary of War. Four enlisted men of the Air Corps and two of the Signal Corps will comprise the personnel of the field.

More than 8,000 towns of from one to ten thousand population, have identified themselves by proper roof markings as an aid to aerial commerce, the Guggenheim Fund reports.

Specifications have been filed with the Bureau of Aeronautics for the construction this year of 1,361 airports throughout the United States at a cost of $75,000,000.

Curtiss-Wright Flying Service has put into operation a marine base at Miami, Fla.

ARMY & NAVY

The Municipal Council of Infanta, Tayabas, P. I., recently passed a resolution thanking the Army Air Corps for its work in connection with a flood in that city.

The Army Air Corps is to make aerial photographs of prehistoric irrigation canals near Phoenix, Ariz., for the Smithsonian Institution.

DISTRIBUTORS

The Ludington-Philadelphia Flying Service, Inc., has been appointed distributors in its territory for the Curtiss-Wright Corp. Plans have been made for a sales and display room near the business center of Philadelphia.

C. T. Stork Corp., New York City, has been appointed metropolitan distributors of Great Lakes Aircraft Corp., and American Aeronautical Corp. The firm will also act as Eastern service agents of American Cirrus Engines, Inc.

Sidles Airways Corp., Lincoln, Neb., has been appointed distributors of Curtiss-Wright products for the state of Nebraska. A. A. Risser of the Norfolk Flying School, and Midwest Aviation Corp. have been named dealers.

Edwards Motor Co., Lexington, Ky., has taken over the Arrow Aircraft Motors Corp. distribution.

Truxal and Hightower, Kansas City, Mo., have taken over the distribution of the Davis Monoplanes in their territory.

L. H. Collins, Little Rock, Ark., was named distributor of the St. Louis Aircraft Corporation's Cardinal line.

FOREIGN

Use by oil companies of airplanes of foreign registry has been authorized by the Venezuelan government. The decree provides that the planes shall be at the disposal of the government whenever they may be urgently required.

Two cabins and a large salon are features of a new airplane, built in France. It is of all-metal construction and seats 28 passengers. An outstanding feature is the fact that all engines are accessible during flight.

The Imperial Airways, operating between London and Paris, have cut their rates on the 8 a. m. airliner to Paris from $23 to $17. The new fare is less than that on a first-class boat and train.

Several of the larger aeronautical companies in France are merging. The new group is to be known as the Societe Generale Aeronautique, and will be capitalized at about $16,000,000.

The London Aeroplane Club, Stag Lane Airport, has a membership of 520, and the National Flying Services' new club at Hanworth has 534. These are the largest flying clubs in Great Britain.

The Chambre Syndicale of the French aeronautical industry will conduct an international aeronautical exposition in the Grand Palais at Paris in November.

With the exception of the Basel-Geneva-Marseille-Barcelona line, Swiss commercial aviation lines have suspended operations until April 1.

Experiments are to be made with special bombs to be used with airplanes in catching fish off the coast of Norway.

A new air service between Sydney and Melbourne, Australia, has been announced by the Australian National Airways, Ltd.

Eight new types of air mail stamps have been put on sale by the Brazilian Post Office.

INVENTIONS

A one-man "Sikorsky dolly" has been designed to meet service hangar requirements by Air Associates, Inc. The device enables one man to handle the twin-motored amphibian. The Sikorsky Corporation has ordered five for plant requirements.

The Imperial Brass Mfg. Co. exhibited its Hi Duty Sky Service Connection, designed to overcome airplane fuel line failure, at the St. Louis Show. The connection has been adopted by the Sky Specialities Corp.

A 12-foot platform, expected to save two and a half or three hours in servicing tri-motored planes, has been designed by D. E. Garrett, a mechanic for Southwest Air Fast Express, and is being assembled in the S.A.F.E. shops.

The Clegg Lock Washer Corp. is preparing to place on the market the Ded-Lok washer, which is claimed to solve the problem of loosening nuts on airplanes.

A Waco plane, equipped with a stock Franklin automobile engine, recently made a flight of an hour. A speed of 80 m.p.r. was attained.

The Glidden Co. has perfected a pure asphalt coating for the interior of pontoons by emulsifying asphalt and water.

MISCELLANEOUS

Application for listing on the New York Stock Exchange for Thompson Products, Inc., stock is seen with the creation of 300,000 shares of no par common stock to replace the present Class A and Class B common stock. The change was approved by stockholders.

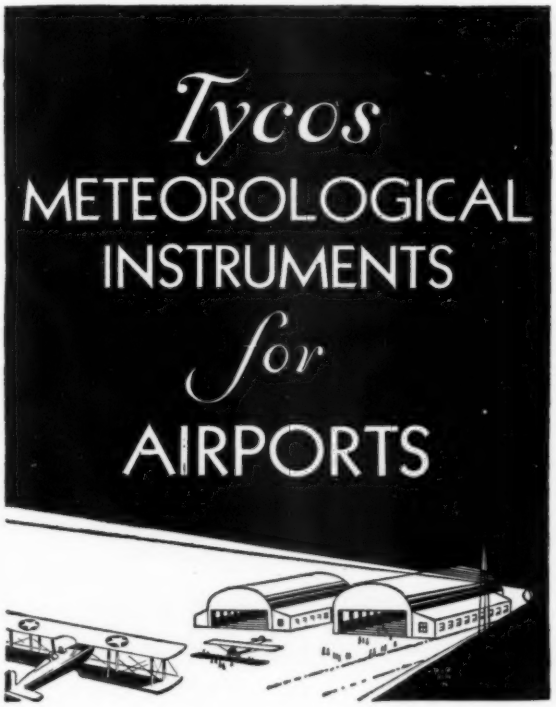
Net earnings of the Pickwick Corporation for the nine months, ended Sept. 30, were $632,199 after all interest charges and preferred dividends, but before federal taxes and depreciation. This is equal to 98 cents a share on common stock now outstanding.

The Lambert Model R-266 aircraft engine has been granted a Department of Commerce approved type certificate. With the granting of this certificate, all the engines and planes manufactured by subsidiaries of Allied Aviation Industry are approved.

The General Development Co. and the Airamerican Supertransport Co. have placed their advertising accounts with the Chas. Dallas Reach Agency. The advertising of the first named company will be institutional in character.

Dividend payments include: Fairey

Meeting Government Requirements for Accurate Weather Knowledge



"ALL airports, whatever their size, should be prepared to furnish information about the weather."

This is a familiar statement to airport owners and managers, taken from the Department of Commerce bulletin "Notes on Airport Management" and part of an article saying that minimum information should include the wind velocity, temperature and barometric pressure. Records of humidity, maximum and minimum temperatures, and rainfall are given as desirable.

TYCOS Instruments for airports fulfill these requirements. Seventy-eight years' experience manufacturing fine instruments has given Taylor Instrument Companies an enviable reputation for high grade products. TYCOS weather instruments are used by the U. S. Weather Bureau, U. S. Navy, U. S. Army Air Corps, and leading airports. TYCOS weather instruments are made of the finest material, built by skilled mechanics, and tested and retested to insure their accuracy.

Write for our booklet, "TYCOS Meteorological Instruments for Airports," which has been prepared by our aeronautical engineers and prescribes the proper instruments for every size airport.

For pilots and airplane manufacturers is our complete catalog of TYCOS Instruments for Aviation. Write for a copy.

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Aviation Co., Ltd., 12 cents a share on American shares; Airparts & Tool Corp., an initial dividend of 18¾ cents on Class B stock; Western Air Express, regular quarterly dividend of 15 cents.

One hundred miles an hour is the most profitable speed for airplanes at which the ratio between operating expense and upkeep and payload is such that a profit can be shown, the Department of Commerce reports.

The Detroit Aircraft Corp. has formed an export division to handle sales in South and Central America, China, Japan, Australia, New Zealand and South Africa. I. J. Miranda has been appointed general manager.

An association for the regulation of wages and working conditions of pilots and mechanics in the aeronautical industry, is being formed in Kansas City by the Globe Aero Service Bureau.

Ryan Aircraft division of the Detroit Aircraft Corp. is planning to put 100 airplane salesmen on the road and establish agencies in every town with 10,000 population or over.

Operations have been started at the new mid-western warehouse of the Curtiss-Wright Flying Service in St. Louis. This is believed to be the first aviation parts warehouse in America.

The Bellanca Pacemaker, equipped with floats, made a high speed of 136.22 m.p.h. when loaded with a gross weight of 4,605 pounds during a Canadian government test at Ottawa.

The Sikorsky Aviation Corp. is now furnishing a skilled mechanic with each Sikorsky amphibian sold. A school for mechanics is conducted at the Bridgeport plant.

Stinson Aircraft Corp. has ordered 500 motors from the Lycoming Manufacturing Co., W. H. Beal, vice-president of the latter concern, announces. Delivery is to be made by May 1.

The second annual Pittsburgh Aircraft Show will be held at Motor Square Garden, March 6 to 15. Plans are being made to take care of more than 100,000 visitors.

Capital of the Pickwick Corp. has been increased from $10,000,000 to $15,000,000 by vote of stockholders. An expansion program will be undertaken.

The American Eagle Aircraft Corp. reports an increased gross business in 1929 of 15 per cent as compared with 1928.

Curtiss Robertson Co. stockholders have approved retirement of preferred stock.

PERSONALS

Grover Loening is now devoting his entire time to the recently incorporated Grover Loening Co., which will specialize in new and advanced designs of aircraft under contract for both the government and private manufacturing firms.

Cessna Aircraft Company's contract with Major Howard F. Wherle has been concluded by request. President Clyde V. Cessna, of the company, will act as general manager.

Frank T. Coffyn, one of the two members of the original Wright Brothers team left in this country, has joined the staff of the General Development Co., of Hartford, Conn.

R. Stuart Murray, director of the Argentine bureau, New York, has joined the Jordan Advertising Abroad, Inc. He will specialize in aviation and allied accounts.

Dr. Albert F. Zahm has been appointed to the Daniel Guggenheim chair of aeronautics at the Library of Congress, recently endowed by the Guggenheim fund.

Joseph P. Disbrow, Long Island representative of General Motors, has taken over his duties as vice-president of the Gates Aircraft Corp.

Carroll M. Aument is now factory manager of the Fokker Aircraft Corp. at both the Teterboro and the Passaic plants.

Harry P. Mammen, president of Parks Air College, Inc., has resigned to enter another business.

John McHugh Stuart has been engaged as publicity director of Fokker Aircraft Corp.

SCHOOLS

Aviation students, normal physically and mentally, have only about one chance in three of obtaining an airplane license in less than a year, it was estimated by the Department of Commerce. The conclusion was reached after a study of the records of more than 9,000 flyers.

The faculty of applied science of McGill University has provided a course in aviation and aeronautics in cooperation with the McGill Light Aeroplane Club. McGill is the first Canadian university to provide a flying course.

The Art Goebel School of Flying, Kansas City, Mo., has been officially licensed by the Department of Commerce. The Goebel School's flying field at Liberty, Mo., received an A1 rating from the government inspectors.

An employment department, designed to provide Parks Air College students with jobs to pay part of their school expenses, is being operated by the East Side flying school. Forrest Cannon is in charge.

The Kearney-Arrow Flying Services, Inc., has been organized at Kearney, Neb. The school will be equipped with Arrow Sport planes.

A total of 13,539 hours was flown at Parks Airport during 1929. It was computed that the total represents 1,083,120 miles of travel.

Eleven planes were destroyed when an explosion, caused by escaping gas, fired the Braley School of Flying.

An advanced transport course has been added to the curriculum of the Spartan School of Aeronautics.

Cost of the transport course at Parks Air College has been increased from $3,715 to $4,500.

Parks Air College has purchased two gliders from Gliders, Inc., for instructional use.

TRANSPORT

William P. MacCracken, chairman of New York Rio and Buenos Aires Line, Inc., recently added final orders for flying equipment that will place 27 multi-motored transport planes in operation over the 9,000 mile route. Four Ford tri-motor transports are included in the 14 planes now in use.

A special air-travel rate for American business has been announced by Universal Aviation Corp. The plan is made possible by the issuance of airscrip book which contain $250 worth of coupons, which are exchangeable for air passage at regular rail rates at any Universal ticket office.

Following reduction in fares from ten cents to five cents per mile has increased passenger traffic more than 300 per cent over the lines of the Southwest Air Fast Express. These new rates are in some instances below the rail and pullman charges.

The Airamerican Supertransport Co. has been organized to operate an airline between New York and Chicago for passengers, mail, and freight. The newly designed Christmas type supertransports, of the General Development Co., are expected to be used.

Construction work has been started on the first two of a new series of Sikorskys—the S-40, a four motored, 41 passenger, ocean going amphibian. They were ordered by Pan American Airways for Service between Miami and Cristobal.

Colonial Air Transport has abolished tipping on the New York-Boston run. The company has also abolished the steward system, employing couriers instead, who will meet passengers at the hotel terminals, and accompany them to their destination.

Airways Corporation of America, which plans to run a passenger service between the two oceans, has been incorporated in Delaware. Amos A. Fries has been named president and general manager of the company.

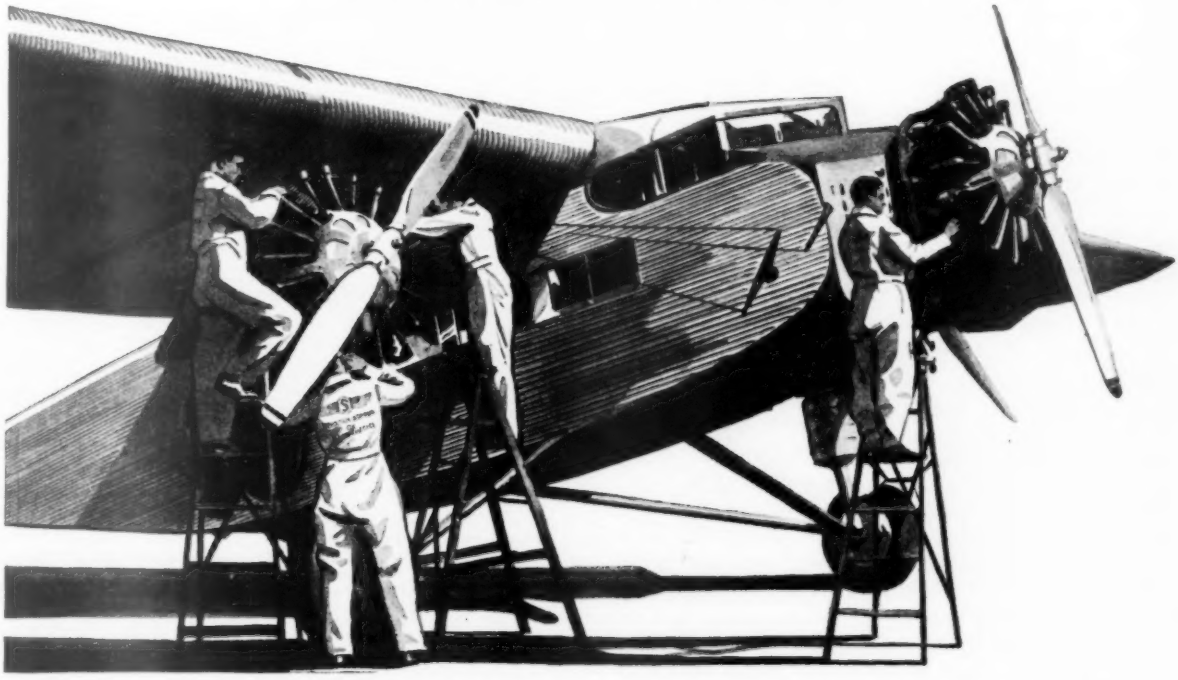
Bellanca Aircraft of Canada, Ltd., has been organized to take over the Bellanca Aircraft of Canada, Registered. The new company is not a subsidiary of the United States company.

A reduction of $107.51 over the former transcontinental rate has been put into effect by T-A-T—Maddux Air Lines. The fare now is $159.92.

XUM

And now . . . . Tri-motor Training

at America's finest aviation school



MAKING it easier for many pilots to realize an ambition . . . preparing them to fly tri-motor planes . . . giving transport lines a dependable source from which to obtain experienced pilots—these advantages are now available at the Spartan School of Aeronautics.

By special arrangement with the Southwest Air Fast Express, Spartan now offers a complete course of training in tri-motor planes including flying and mechanical instruction, and lectures covering theoretical and technical subjects.

America's Finest Aviation School

In this new advanced transport course the Spartan student receives instruction in take-offs, stalls, recoveries, cross-wind landings, banks up to 90 degrees, wing-overs, and tight vertical spirals. In addition he receives extensive ground school work not included in standard transport courses.

The Spartan advanced transport course has three outstanding advantages over any other tri-motor course:

(1) Flight instruction, shop and lecture courses are supervised by air line executives who are among America's most experienced pilots of tri-motor planes. (2) The student may observe methods employed by the Southwest Air Fast Express which operates fourteen tri-motor Fords with Tulsa as its base. (3) The student is thoroughly instructed in fundamental air line business principles . . . traffic and operations . . . at the actual executive headquarters of a great air transport system.

Students in the advanced transport course (as in other Spartan courses) may take advantage of a liberal extended tuition payment plan. For complete information mail the coupon below.

SPARTAN SCHOOL OF AERONAUTICS

TULSA • OKLAHOMA

SPARTAN SCHOOL OF AERONAUTICS, TULSA, OKLAHOMA.

Gentlemen: Please send me your new 1930 illustrated booklet and full information regarding your courses, extended tuition payment plan and free air transportation to Tulsa.

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XUM

AERIAL NAVIGATION [*Continued from page 40*]

Hence, it is necessary that ordinary topographical maps, and in some cases, charts must be used for aerial navigation.

It is generally accepted that a map scale of ¼ in. to 1 mile is about the most suitable for aerial use, and on this scale it is impossible to include much detail without making the map extremely difficult to read, as a clearness is of foremost importance in an air map, and this can only be obtained by omitting a great many features from the map, and using conventional signs, to denote many other features which are necessary because of their importance as landmarks and for other special reasons.

Map reading, whether aloft or afloat, requires a clear understanding of the conventional signs used, of scale of the map, and of the direction of *true* or *magnetic north*. The novice must remember that the right and left hand edges of the map *are not* always parallel to the meridian. The magnetic variation of the locality is usually clearly shown; this is particularly true in the case of the new Canadian Airway Strip Map. (See Fig. 3.)

The title is a portion of a map or chart that often receives scant attention, whereas it is in reality, "the key to the chart," and should be carefully studied. The title usually includes the date of the survey, and a list of abbreviations and convention signs. It is practically impossible, however, to include all the signs used in the title, and the airman should make himself acquainted with the majority of the signs used on the maps he is using. Lists of the conventional signs are published as separate sheets by the various survey authorities concerned.

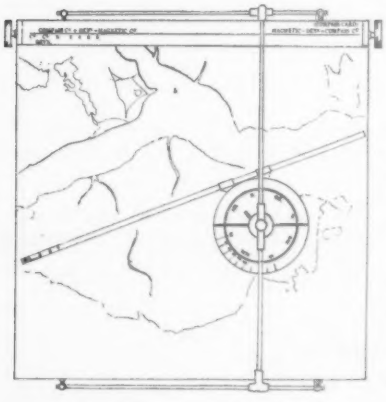


Fig. 4. Jessen combined chart holder.

Fig. 3. Small maps of airports are printed on back of strip map and not as shown here.

The correct arrangement of maps or charts should, if possible be completed on the ground before the beginning of the flight. The track between the place of departure and the objective should be laid down on the map. When possible, maps should be carried in a Bigsworth or Jessen chart holder (Figs. 4 and 5) (or something similar), and should be arranged in the order in which they will be required.

If a chart board is not available, the map should first be folded so that the whole of the track is visible, and then again folded to a convenient size and arranged in such a way that the track can be seen by turning over the folds one by one. Care should be taken that latitude and longitude scales, in case of charts and distance scale on maps, are always readily accessible.

A pilot should, when circumstances permit, study the general character of the district over which he proposes to fly. This preliminary study will enable the pilot to decide on the desirability of making a direct course or of avoiding any prohibited area.

The altitude at which the flight will be made may be largely determined by the hill features of the country to be flown over. While considering this question of altitude, it must be remembered that if the altimeter is set at zero at the point of departure, it records heights *above the level of the point of departure*—so that altimeter reading will often be far from actual height of the aircraft over the ground. Special prominent objects on or near the track, should be noted and it will often be found useful to "wash in" a colored circle around some of the most important. Care should be taken that the coloring of the circle does not conflict with the color scheme employed to denote altitude, etc.

A "time scale" marked along the track is also of great assistance when it is possible to use one.

Landmarks and Seamarks

Considering landmarks, strangely enough, water is one of the best landmarks, and can generally be seen at great distances, and rivers, lakes, etc., are usually very clearly marked on the map. After long rains care should be exercised in distinguishing large flooded areas from lakes. Railways form good marks, and are generally used by pilots. Junctions and crossings are particularly valuable, while woods are only valuable if the map conforms strictly to their shape. Roads and towns are of course generally used, and the R.A.F. map of Great Britain shows all the golf courses, this being easily distinguishable from the air.

Here is a suggestion for the U.S. golfer—mark all of their courses for the airmen.

Large private houses, factory chimneys, windmills, gasometers, water towers, etc., are useful as marks, but are not as a rule, marked on the ordinary topographical map.

It must also be borne in mind that the individual characteristic of a mark is rarely as important to the navigator as its relationship to some other landmark. For instance, a particular

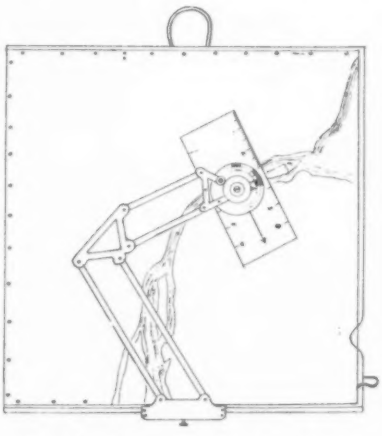
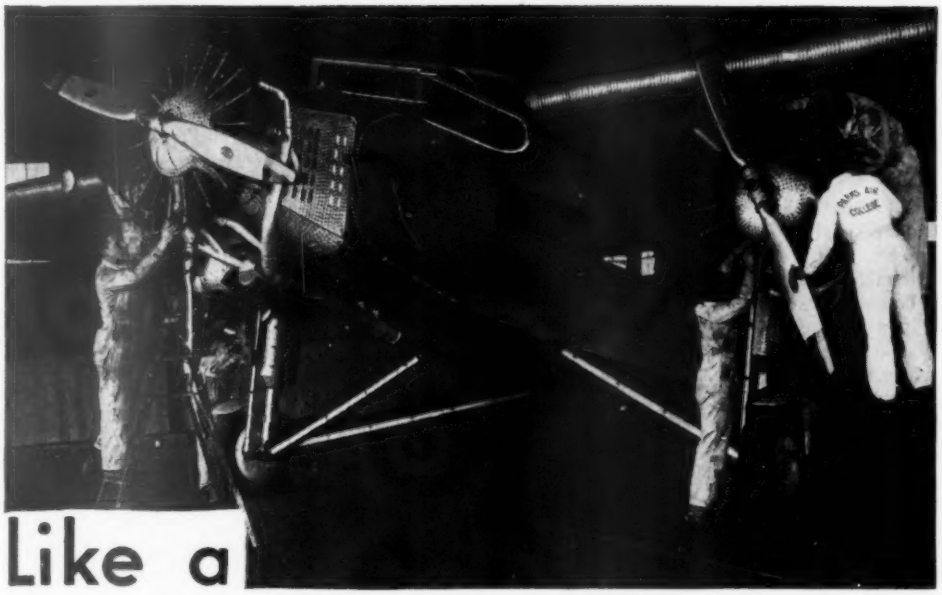


Fig. 5. Bigsworth chart board and protractor.



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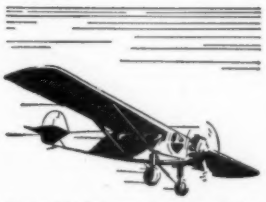

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church may form a prominent mark, but churches look very much alike from above. But suppose the church is known to be lying, say, five miles north of a railway junction, or close to a windmill, it is unlikely to be mistaken for another church within the same area.

Seamarks may be divided roughly into six classes,—light ships, light buoys, main steamer tracks, cliffs (these frequently have distinctive colors), lighthouses, and conspicuous towers and buildings, etc. (if near the course), and finally sandbanks, rocks and shores which usually show up very clearly and make excellent marks.

Night Marks

The degree of visibility at night naturally varies according to atmospheric conditions and the amount of moonlight, but whatever may be the condition, ability to see at night, to distinguish ground features and to estimate distance, can only be developed by careful training.

Even on clear moonlight nights, it is difficult to distinguish every small detail and the first view of an object is usually a dim outline.

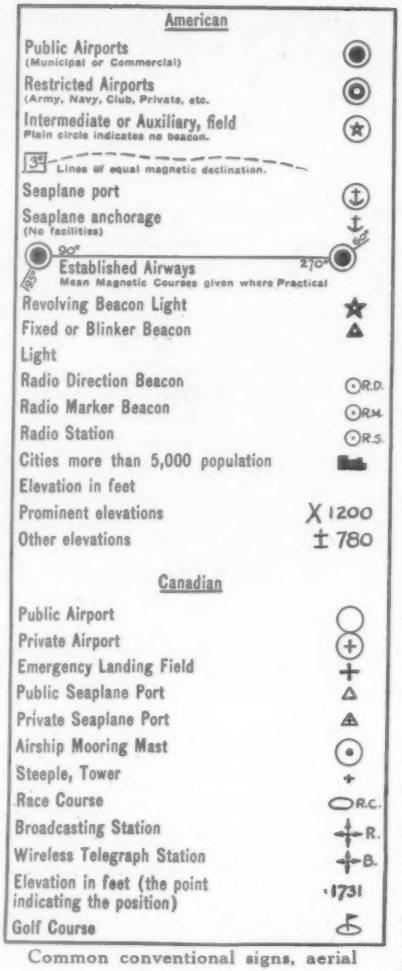
Trees are troublesome in hindering night observation, due to the shadows they cast. On full and half moon nights, the shadows cast by trees and other ground objects is great, and these shadows are frequently mistaken for ground objects.

The following table from Air Pilotage Manual gives the relative visibility of ground objects as follows:

(A) Woods and forests—are very useful landmarks on clear nights and can be recognized up to a great altitude.

(B) Rivers and lakes—being good reflectors of light, are easy to distinguish even on comparatively dark nights. By moonlight, on clear nights, stretches of water can be distinguished even from great altitudes, especially when the district under observation lies between the observer and the moon.

(C) Roads and railways are useful landmarks. Roads which are untarred are more visible than tarred roads*, and this fact adds to the difficulty of map reading as most maps, being designed primarily for road users, give prominence to the main roads which are usually tarred.



Common conventional signs, aerial map.

After rain, untarred roads tend to blend with the adjacent land and are less clearly visible. When bordered by trees, roads are less conspicuous, particularly on moonlight nights when the moon is low and the shadows long. Railways can be seen on moonlight nights by the reflection of the light from the rails, but are not easy to follow on dark nights. Trains, especially if steam or smoke is being emitted from the engine, can be seen from a great altitude owing to the reflection of the fire on the steam or smoke. The general direction of railways and main roads, and the relations they bear to each other and to neighboring landmarks should be kept in mind. Passing trains or motor-car headlights are sometimes of assistance in determining the direction of a railway or road.

(D) Towns and villages can often be seen from a distance by their lights, and can generally be identified by their shape and the appearance of the roads or railways running through them. It should be borne in mind that many of the lights are extinguished at an early hour and that the towns or villages are therefore less conspicuous, and appear to have changed their shape, during the later hours of the night.

There is an intensive program of aerial map making in progress in the United States, the work being divided as follows: Department of Commerce (Coast & Geodetic Survey), 44 maps; Army Air Corps, 52 maps; U. S. Navy, 62 coast charts adapted to aerial needs.

Canada has produced her first aerial map and is busy on an extensive program.

However, excellent as these publications may be, and they are improving month by month, an efficient pilot *must* be an efficient *map reader* and that can only be accomplished by careful study. The difficulties of map reading are naturally greater at lower altitudes and it would be useful practice for the budding pilot to fly over unfamiliar country having few distinctive landmarks gradually reducing altitude as his proficiency increased. Navigation institutions in modern commercial schools are at present confined to a little theory and practically no practice.

The Department of Commerce examinations for pilots call for no real knowledge of navigation and include no practical tests.

If there are to be trained aerial navigators, and even the most conservative will admit they are necessary, there must be higher Department of Commerce standards, and more efficient instructions in commercial schools.

*These notes apply particularly to European conditions.

AERONAUTIC LAW [*Continued from page 38*]

injuries done by the lessees of the city. Would there be any duty on the part of the city to police the field to keep off children and other trespassers? F.A.H., Falls City, Neb.

THE city, having subleased the airport to an aircraft company stands in the same position as any lessor, and would not be liable for injuries to anyone by reason of the negligence of the lessee.

It would not be the duty of said city to police said airport premises unless it contracted to do so, and even under such circumstances the airport people would be liable for injuries caused by reason of their negligence.

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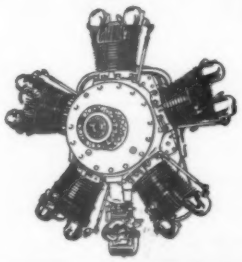

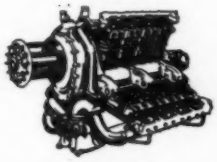

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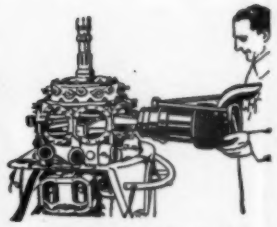

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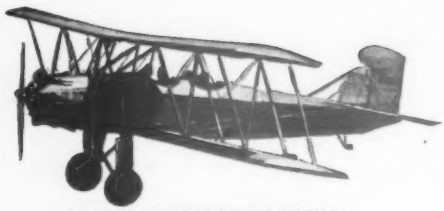

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AERODYNAMICS [*Continued from page 42*]

round a wing: one at the leading edge and one at the trailing edge as shown in Fig. 12.

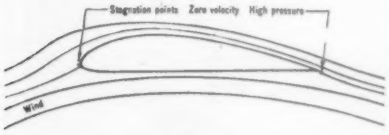

Fig. 12.

By stagnation points are meant points where the air is at rest relative to the wing, and the pressure is therefore at a maximum. The air on the upper surface of the wing has to flow, therefore, from one region of maximum pressure to another region of maximum pressure. There is a simple mechanical analogy to this flow of a particle of air from high pressure point to high pressure point, namely, that of a ball rolling down a curved surface and then rolling up to the top of a similar curved surface (see Fig. 13).

Fig. 13.

The ball as it rolls down is retarded by the action of friction and unless it has some initial velocity is not likely to come up to the top on the second surface. It is more likely to fall back or pull away at some up point on the upward slope. The same applies for the flow of the particle of air. It is likely to tear away from the upper surface of the wing before getting to the second point of high pressure. When the wing is at a high angle of incidence and the lift coefficient is high, the difficulties for the air particle increase so much that it tears away a good distance before the trailing edge is reached and the "burbling," eddying flow follows.

The action of the slot, which appears in Fig. 14, is to create a passage from the under side of the wing where the pressure is high to the upper side of the wing which is under suction. Therefore there is an additional flow of air from the lower surface to the upper surface. If the passage formed by the front auxiliary airfoil and the main wing is properly shaped, with the opening at the bottom somewhat wider than the gap at the top, the air is accelerated in passing through the upper gap. More speed as well as more pressure is thereby added to the air flow on the upper surface of the wing. The air particle gets a species of a "kick" from this auxiliary flow and has therefore no difficulty in getting smoothly to the trailing edge.

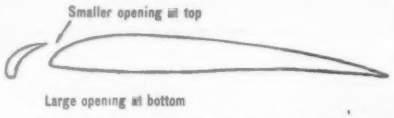

Fig. 14. **Venturi slot in front of leading edge of wing.**

The use of the Handley Page slot therefore retards the "burbling" of the wing. And we have seen in previous articles that if the lift of a wing occurs at a higher angle of incidence the maximum lift is also increased.

Fixed Slots Ineffective

Experiments have been made with fixed slots of the type shown in Fig. 15. Such slots may be made to increase the maximum lift slightly and also to raise the burbling point to a higher angle. At the same time such fixed slots really constitute a tandem wing.

Fig. 15. **Fixed auxiliary airfoil to produce higher maximum lift.**

The vertices dropping off from the trailing edge of the front wing put the main wing in a downwash of air and therefore the drag of the system is considerably increased. A fixed slot is likely to be of very little use in reducing landing speeds and will act very detrimentally on the general efficiency of the airplane.

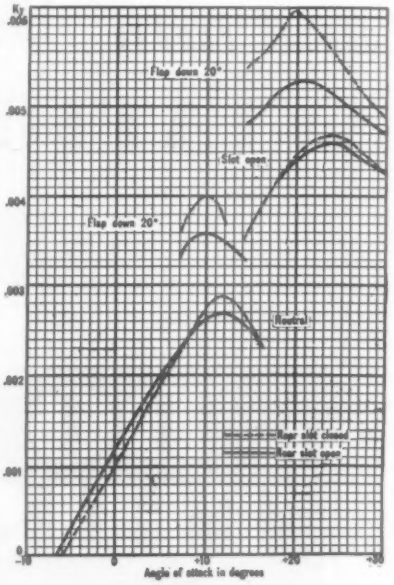

Fig. 16.

Why Slots Should Be Used in Combination with Flaps

About two years ago the author compiled in an article in Aviation the accompanying table (Table 1) of the results obtainable from averaging up a large number of tests.

From this table it is seen that the use of the front slot alone does not give as high an increase in lift as the use of slots in combination with rear flaps. Also, the use of the front slot alone means that the maximum lift is obtained at a very high angle of incidence. In order to get the full benefit

TABLE NO. 1

Type Section	Average maximum camber	Average increase in maximum Ky	Burbling angles of basic and slotted sections	Average change in maximum angle
Effect of Front Slot Alone				
Thick	14.67%	35.8%	15.8° to 24.25°	8.45°
Medium	12.10%	44.0%	12.91° to 20.45°	7.34°
Thin	7.2%	61.0%	14.12° to 25.1°	10.98°
Effect of Slots and Flaps Combined				
Thick	15.1%	43%	16.67° to 22.34°	5.67°
Medium	12.1%	68%	12.91° to 13.75°	.84°
Thin	7.1%	75%	13.17° to 17.83°	4.66°

TABLE NO. 2

Condition	Max. Ky	Angle of Incidence
(1) Front slot closed, rear slot closed, flap neutral	.0028	12°
(2) Front slot closed, rear slot opened, flap neutral	.0031	12°
(3) Front slot closed, rear slot closed, flap down 20°	.00367	10°
(4) Front slot closed, rear slot open, flap down 20°	.00408	10°
(5) Front slot open, rear slot closed, flap neutral	.004070	24°
(6) Front slot open, rear slot open, flap neutral	.00474	24°
(7) Front slot open, rear slot closed, flap down 20°	.00525	20°
(8) Front slot open, rear slot open, flap down 20°	.00602	18°

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of the slot, the airplane would have to be built with a high, stilt-like chassis, which is of course a disadvantage from the general design point of view; the landing gear would have to be heavy and would offer also more air drag.

The use of the rear flap with the slot, brings the angle of incidence down considerably and therefore makes the use of the slot far more practical.

More Modern Results with Slots

From Table 1 it would appear that more powerful results can be achieved with thin wings, rather than with thick wings. But more modern experiments both in England and in the United States (including many experiments in the wind tunnel of New York University) have made it quite evident that 100 per cent increase in lift is quite possible even with basic sections of high camber and high lift. In other words it is just as advantageous to apply slots and flaps to thick wings as it is to apply them to thin wings.

So many tests have been carried out on wings of different types with slots of different designs that it is impossible even to summarize these tests in our article.

We will give the results for one wing, the R.A.F. 31 recently published by Mr. Handley Page.

These results are illustrated in Fig. 16 and Table 2.

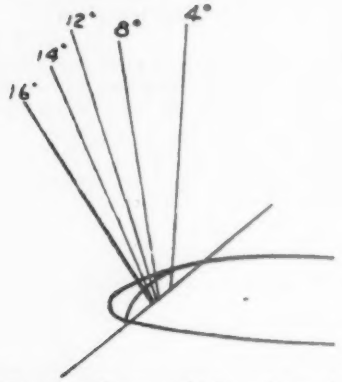

Fig. 17—Forces at high angles tend to open slots.

From these curves and the table the following results are apparent:

Flaps alone are not very effective.

Slots alone are not very effective, although more powerful in action than the flaps alone.

Slots combined with flaps give extraordinarily high increase in maximum lift, and at the same time the angle of maximum remains reasonably low.

The use of a slotted flap with the front slot is even more effective than the action of an unslotted flap.

Front slot plus rear slotted flap can give a total increase in lift of more than 100 per cent.

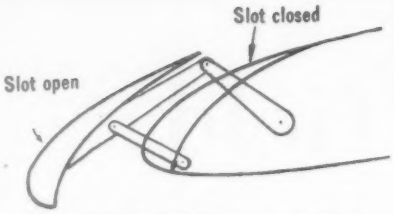

Fig. 18—Parallel type of link mechanism.

The Automatic Slot

The great argument against the use of slots on the part of conservative designers has been that they meant another gadget for the pilot to use.

Within the last two or three years another great dsicovery by Mr. Handley Page has done much to remove this objection.

And that is the fact that the slot can be made to act automatically.

Fig. 19—Straight line roller type of mechanism.

We have learnt in previous articles, that as the wing goes to a higher angle of incidence, the suction on the wing goes towards the leading edge (as does the center of pressure) Fig. 17 shows how the resultant force on the front airfoil acts in magnitude and direction as the angle of incidence of the main airfoil changes. With the slot closed and the incidence at 2 degrees the resultant force K_r shown in the diagram acts backwards and there is no tendency for the slot to open. But as the angle of incidence increases, the force on the auxiliary airfoil increases and also moves forward and swings round till it points definitely away from the wing.

Now if the slot is mounted on a link motion as in Fig. 18 or on a roller type mechanism as in Fig. 19, then when the main airfoil gets to a large enough angle, the force K_r will evidently open the slot automatically. By suitably venting the slot at the top (see Fig. 20) the opening of the slot may be delayed. By venting the slot at the bottom, the opening may be hastened.

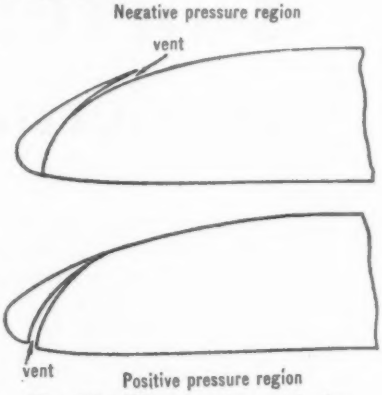

Fig. 20—Wing section with forward aerofoil fitting close on front or on rear edge. To delay opening, slot is vented at top rear edge of auxiliary aerofoil. To hasten opening, slot is vented at bottom front edge of auxiliary aerofoil.

By suitably interconnecting the slot and flap, it is possible also to make the action of the flap automatic. When the slot opens, the flap goes down. When the slot shuts, the flap comes to neutral. The mechanism of Fig. 21 is only one of many that might be devised. It is not so certain that interconnection of the slot and flap is altogether desirable. Under certain conditions the upward force on the flap may overcome the opening tendency of the slot and so close the slot just when its aid is most needed.

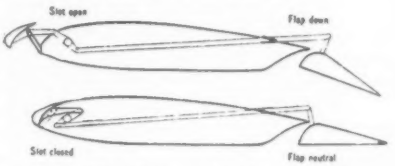

Fig. 21—Automatic slot and flap action.

Slot Sure to Come into Its Own

The results of the Guggenheim Safe Aircraft Competition, won by a Curtiss plane equipped with Handley Page slots and flaps, have shown conclusively that this device is of inestimable value to aviation.

It may be said that with proper design, the lift can be doubled, the landing speed reduced by about 20 per cent, the length of run cut down by approximately 75 per cent, and the take-off also improved. It is the author's considered opinion that the Handley Page slot is one of the most valuable contributions to practical aerodynamics, and that the next few years will see its use on a great many commercial machines.

AN INVITATION

We invite comments from our readers on the articles and editorials carried in Aeronautics. Requests for special material for inclusion in future issues will be carefully considered.

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[Please see index, page 98]

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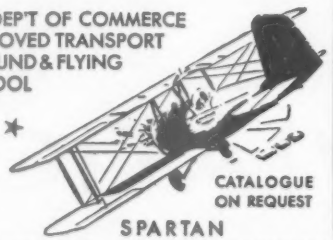

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SMALL TOWN AIRPORT

[*Continued from page 33*]

he believed had possibilities he advised the removal of several stonewalls, the clearing away of about 200 feet of second growth timber, the building of a good road to the field from the main highway the bringing of electric telephone and telegraph lines to the property, the establishing of airplane accessory and repair service, the equipping of suitable housing quarters for pilots and the building of one or two good hangars. With this done, we would have a landing field but not an airport, as the property, if improved, would not permit landing and taking off in all directions which is a requirement of a really good airport. A few days after the expert left town, I received a written report which I subsequently read at a meeting of the chamber of commerce. It seemed to me that the committee on aviation had a definite proposition to present, and, after going into some detail with regard to the number of properties which the committee had inspected, I suggested that something be done to get the refusal of the property which had received the expert's approval. It so happened that the owners were not using the land and were willing to consider selling for aviation purposes. Then the real airmindedness of the New England community began to be apparent. In short, the idea of having a good landing field was splendid, provided the other fellow paid for it. A prolonged discussion of the matter resulted in nothing definite being done to acquire the only likely property in the township which is situated in a very hilly country.

As chairman of the aviation committee, I tried to point out that, at first, there would be no financial returns; but, that by having a place for airplanes to land and to be serviced, our town would attract air traffic which otherwise would be compelled to go elsewhere. I pointed out that we were very much like a town 25 years ago which was debating whether or not to have a garage as there were so few automobiles and it would not pay. Although airplanes may not be as numerous as automobiles, nevertheless, there certainly will be many thousands in the air within the next few years. Air-tourists are going to towns and cities where they can get good service just as truly as the motor-tourist of today selects his route where he knows that he can find the accomodations and the service he likes. Our town has a large summer population which within the next few years is coming to us by air, as well as by railroad and automobile.

It seemed to me that some of these facts could not help but be self-evident; but, as yet, there are many good citizens of large and small towns who have no vision of the future and who seem to be utterly unable to become airminded enough to keep pace with the times. These men and women are not to be considered uneducated or even prejudiced. It is simply a case of aviation, as a whole, being so far removed from their daily experience that it assumes the same place with arctic exploration—very interesting, to be sure, but nothing which demands personal thought and effort in a small New England town.

For that very reason, a landing field in a community will do more to sell aviation to the people than reams of reports and recommendations from aviation experts. The arrival and departure of a few airplanes will attract more attention and interest than practically any other activity which reaches the average small town. It is reasonable to assume that a landing field which is financed by citizens of a town, or the town itself, cannot fail eventually to become a profitable investment. There is no sidestepping the fact that air-traffic cannot come to the town that lacks a landing field. If good roads attract the motor-tourist, there is no disputing the statement that good landing fields will attract the air-tourist. And, yet, try to make these facts clear to those who mean well but who lack the ability to visualize community needs further ahead than the next town meeting. Probably it is history repeating itself. There were those who had no faith in the steamboat, railroad and automobile, and yet, in due time, these three methods of transportation won public approval and confidence. The airplane, I believe, will prove to be no exception.

From the preceding paragraphs I hope that I have made my point clear that in most small towns in northern New England the establishing of an airport depends upon the available level ground, if any, and the attitude of the townspeople toward aviation today and tomorrow. Furthermore, I believe that towns in other hilly and mountainous parts of the United States are faced with similar problems.

If for the present those who hold the purse strings are not airminded and are openly opposed to the establishing of the small-town airport, let us take com-

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fort in the reflection that in the early days of the steamboat and the railroad there was bitter opposition which time alone could melt away, and did. In most cases, those who are opposed to aviation know very little about it. It is more a case of ignorance rather than the carefully planned opposition of the well-informed obstructionist.

In our town there were some warnings of concerted opposition from summer residents who stated that they had purchased or built their summer homes in our town because it was quiet. If an airport were established and airplanes began to fly over their properties these summer residents assured me that they would leave town. There is something to their point of view; but what would we think of the summer resident who today would object to the noise of an automobile. In fact, were it not for his motor car many a man would never get very far from the city or have a summer home in northern New England. And so, let me conclude with the wish that my somewhat disjointed observations may be of some interest and value to others who are chairmen of aviation committees in small towns that are not yet financially airminded.

FLIGHT TRAINING

[*Continued from page 30*]

possible; at the same time trying every stunt he knows to prevent his opponent from getting pictures of him. Although the students are given three hours for practice, each dog-fight is limited to a three-minute period, and due to the severe strain of this mimic fighting, students seldom engage in more than four of these three-minute periods each hour. At the end of each fight period, the planes pull out and climb back to 12,000 feet before beginning another encounter.

The 50-hour combat course at Pensacola is just the beginning of training for pilots assigned to duty with the Battle Fleet. In viewing the many aviation film-features that are presented, one can best get an idea of the perfection to which fighting-formations attain. But there are hundreds of hours of gruelling practice behind this perfection. The 18-plane Hawk formation seen in "The Flying Fleet," was not the result of a producer's whim. Those pilots had been practicing together for years, and the three-plane formation in the same picture was piloted by Naval Aviators who had spent three months in "rehearsal."

Although formation-flying is stressed in combat practice, because of its tactical advantages, so long as the single-place fighting plane retains its effectiveness as the weapon by which aerial security is assured, the personal element, the merits of the individual fighting pilot, will remain dominant in aerial warfare.

In analyzing the careers of the pilots who stood out boldly above the fog of battle in the World War, Lieut. T. B. Lee has found that they fall broadly into three classes. Says Lieut. Lee: "These three groups reveal to a certain extent the stages through which aerial combat passed and may be taken as indicative of the progressive development of aerial tactics. It must be remembered that the first combat pilots were without precedent. Their mission alone was clearly defined. The methods they employed to accomplish their mission were peculiarly their own."

As a representative of the first type, Capt. Albert Ball, the first great British ace, and Capt. Georges Guynemer, were selected. "They knew neither fear nor caution," points out Lieut. Lee. "Fired with a divine spark of determination and devotion to duty, they were eternally on the aggressive. Fighting alone by preference, they unfailingly forced a combat, impetuously engaging an enemy formation of 20 planes with the same ferocious, smashing attack with which they greeted a single opponent. Their sheer audacity carried them along to victory. An enemy sighted was an enemy to be engaged by a direct approach along the shortest line without regard for position or odds. This most direct of methods contained three elements of successful tactics: Initiative, determination, surprise. They enabled Capt. Guynemer to gain 53 victories and Capt. Ball, at the age of 20, to be officially credited with 44 enemy planes. But their rash self-exposure to enemy fire returned them to their hangars many times with their planes, and often their clothing whipped to shreds by enemy bursts. It caused Guynemer to be shot down seven times by enemy aircraft. He fell for the last time on Sept. 11, 1917. Capt. Manford von Richthofen won his twentieth combat over Capt. Ball in May, 1917."

Capt. William A. Bishop, the Canadian leader of the British Royal Flying Corps, and our own Maj. Raoul Lufberry represent the second type. Lieut. Lee finds, however, that: "The line dividing their tactics and those of the brilliant Ball and Guynemer is but faintly drawn. Bishop and Lufberry with their judgment, marksmanship and flying, coupled their experience and its accompanying finesse, launched the

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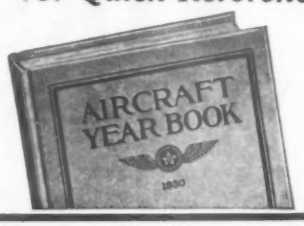

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same savage, driving attack that characterized Ball and Guynemer. Where the latter forced the issue under any circumstances, against any odds, Bishop and Lufberry tried first to shape conditions to their advantage. Maj. Lufberry was brought down in flames by a Fokker triplane on May 19, 1918, after 18 official victories. Col. Bishop was withdrawn from active service at the front with a record of 72, that he might contribute his tremendous share toward the indoctrination of student pilots. Their tactics contained the elements of initiative and determination in common with those of the first type. Surprise was more often employed. The important element which they contributed to the method of Guynemer and Ball was the recognition of the value of the tactical advantage of position."

Lieut. Lee continues: "Clearly defined from the two preceding groups, there stands now the highly developed, perfectly balanced type, led by Lieut. René Fonck and Capt. Manford von Richthofen. Here are found the same high qualities of gunnery skill and flying ability, but allied now with coolness, infinite patience, and adroitness. Neither Fonck nor von Richthofen ever doubted the outcome of a combat, for once having joined they coolly harassed their opponents into an unfavorable position and then, and not until then, did they drive their attack home. They never received or risked the reception of enemy bursts by headlong plunges into the enemy fire, receiving as good as they gave. Fonck had a string of 35 victories before an enemy shot struck any part of his plane.

"Solely as a contrast of methods," suggests Lieut. Lee, "picture Fonck warily attaining the tactical advantage of an opponent before closing with him, and then witness the miraculous Guynemer with gun jammed beyond clearing, repeatedly diving, unarmed, through bursts of fire, upon a two-place Albatross, until the gunner of the Albatross raised both arms and the pilot spiraled down to land on French soil, a captive."

The designated Naval Aviator of today, with these traditions before him, can accept as doctrine certain golden rules of aerial combat. "But in the last analysis," to quote Lieut. Lee, "even he falls into one of the three groups described. However complete his acceptance of the doctrine of successful aerial tactics, basic fundamentals of mental and physical reaction to the heat of combat will decide whether he adopts the blind plunging of Guynemer or the coldly deliberate methods of von Richthofen and Fonck."

And with these glimpses of heroes, the graduate leaves the "Annapolis of the Air," the Naval Aviation Training Station, at Pensacola, Florida. Those who have received combat training are assigned to duty with a fighting squadron of the Battle Fleet, the others are sent to swell the flying ranks of the Scouting Fleet or the Battle Fleet, in squadrons concerned with observation, torpedo and bombing. They are all fully-winged birds who have left the nest, while every month fledglings report for aviation training, and the Pensacola training station is never without its brood.

ENTERING AVIATION

[*Continued from page 26*]

tures. Working with the bench machinists are the fitters and filers, who handle the fitting and filing requirements on quantity parts production. This work is done to samples and templates and requires only a fair mechanical skill.

Just as the machine shop takes care of fabrication of bar stock, the sheet metal worker fabricates sheets. He must be capable of forming, bending, beading and wiring different kinds and thicknesses of various shapes with the assistance of drawings or samples. Sheet metal workers must understand stretching, compressing and drawing aluminum and its alloys and be capable of accurate workmanship. They operate the usual square and circular shears and brakes, and often engage in riveting, tinning, and soldering in connection with gasoline tanks. Power hammer operators shape sheet metal into concave, convex and unsymmetrical forms as required. They must be capable of judging when the fatigue points of various gauges of metal is reached. Hand bumpers perform somewhat the same work as power hammer operators, except that their work is accomplished entirely by hand and involves the use of small rawhide, wood or rubber mallets on articles which are usually smaller and require more skill.

In connection with the fabrication of materials there are a great many fittings which must be welded. Welders in the aircraft industry must have considerable skill, especially when working on fuselage and other routine framework. Fuselage welding is extremely important where improper joining may cause failure in a struc-

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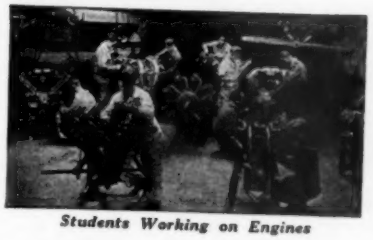

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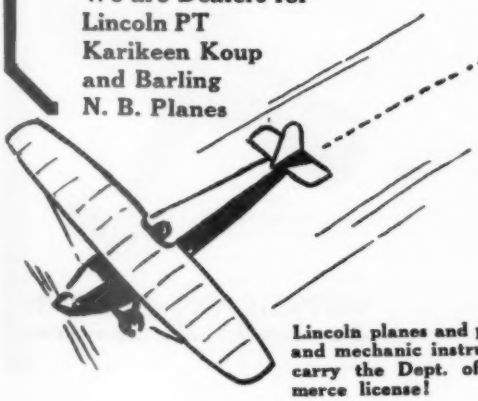

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ture vital to the airplane. These welders must be qualified to judge when a joint is properly welded and be capable of joining thin metal to much thicker metal without burning the light piece, yet properly heating both to form a perfect union. This work is sometimes performed under difficulty in intricate jigs and fixtures permitting only close quarters for the manipulation of the welding torch. They must be capable of adjusting the gases used in regulating the torch to obtain the correct flame for the work in hand. Welding aluminum is more specialized than steel welding and requires a special skill. Sheet welding is performed on gas and oil tanks, while welding on castings is usually to repair cranckcases and so forth. In connection with the Machine Shop, the Metal Department and the Welding and Heat-Treating Department there are a number of miscellaneous jobs which are essential to production and yet too numerous to mention. For example, in connection with welding there is a certain amount of normalizing which must be done and there is quite a lot of furnace work requiring special ability.

After the parts have been fabricated many of them are zinc plated, sand blast being used for cleaning in some cases. Sand blasting demands considerable skill in the manipulation of the sand stream while removing scale, dirt, rust and grease from metal parts. The plating, of course, requires a knowledge of the electric bath and of the general principles of electrolysis. Some of the parts which are not plated are sent to the spray booth where certain types of paints and enamel are sprayed upon them. This is done by the operation of pneumatic spray guns, and those who operate them must have some skill in the manipulation of the proper mixture of air and paint in order to prevent an improper thickness. The drying of the painted parts is an art in itself, for this must be done in a carefully regulated drying room to prevent the paint from cracking and improper crystallization.

Detailed parts having been fabricated, painted or plated as the case may be, bulkheads and other small subassemblies are constructed on jigs. This is more or less routine work, and with the jigs as guides requires less intelligence than some of the other trades. In the case of assemblies such as the wing or fuselage, a canvas cover is necessary. Sewing machine operators sew the wing covering together and after the frame has been covered with aluminum foil, the covering is then sewed on. This is then doped by men specialized in the doping of fabrics. Work of this nature is accomplished by brushing a mixture into the fabric making it shrink to such an extent that it is like a drum. In order to get the best possible results a complete understanding of the working characteristics of dope, room temperatures, drying and so forth is necessary.

After being doped the wing is ready for final assembly. Fuselage assembly, like sub-assembly, requires less skill than some other divisions of production. After the fuselage has been completed, each step in its construction having been guided by fixtures and jigs for the proper placing of the parts, a group of upholsterers, after having laid out and made up leather covers, paddings, cushions and so forth, sees to their installation.

The parts are ready now for final assembly, some having been stored in the stock room while others flowed continuously to the final assembly floor. Riggers are used in the final assembly of planes to attach the wings, tail surfaces and landing gear. They also make the necessary adjustments after the assembly of component parts, such as arranging struts and wires according to specified lengths in order that upon the completion of the various parts and surfaces, all portions will be in proper alignment. They must understand the checking and adjustment of dihedral, incidence, sweepback and other angles the structure may require, by means of landing, flying and stagger wires and be capable of setting the proper angles so that in preparing the airplane for flight all the prescribed dimensions are correct.

The plane having been completed, it is sent to the field for motor testing by motor mechanics who have a thorough understanding of the operating characteristics of gasoline engines, being equipped to make adjustments and overhauls on a variety of engines. Installation of power plant accessories, such as gasoline, oil and air lines is a part of their work, together with the adjustment of the carburetor and ignition systems. Further, they must be capable of adjusting and setting the pitch angles of metal propellers and running ground tests to check proper installation of engines and accessories, locating and correcting any trouble encountered before the plane is finally given its test flight. The actual flying of the plane is done by a pilot.

In sketching a few of the possible opportunities in the airplane business it has been on the assumption that the present tendency is towards the metal plane. This should be qualified because a number of companies are producing wood ships and in so doing they em-

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ploy the services of capable cabinet makers along with wood workers of various types. The shaping of parts is much like that of the metal plane except that the wood has different working characteristics. Any consideration of a subject so large as aircraft personnel must necessarily omit detailed discussion of a number of miscellaneous functions, such as those of blacksmiths, clerks, cable splicers, carpenters, electricians, grinders, mill hands, millwrights, riveters, stock keepers, timekeepers, tinners, tube benders, truck drivers, watchmen, janitors and types of labor common to every industry.

While production is being carried on, a very important man is the stock chaser who follows up various incompleted orders, insuring a smooth flow of production from the time the orders originate in a particular department through the various stages of production, inspection, finishing and assembly. In other words, it is his function to expedite as much as possible the production of parts and assemblies.

In all the stages of the production of various parts and assemblies the corps of inspectors is responsible for the correctness of the parts which make up the plane. Every particular division has an inspector especially qualified to accept or reject fabricated materials or assemblies. These men are trained for their particular job, having a knowledge of blue prints, metals and wood, with some knowledge of engineering which enables them to properly inspect the various parts and the finished product.

In order to determine the selling price of an airplane a cost system must be evolved by the Accounting Department. Time is usually kept by timekeepers in various departments and the slips are turned in to the pay-roll clerk. Costs must be kept on material and operation and these are turned into the Accounting Department where they are posted by bookkeepers after they have been computed by comptometer operators who are engaged chiefly in cost accounting under the direction of cost clerks. The accounting system of an aircraft factory has a special cost basis, but, aside from this, a knowledge of general accounting is adequate.

After the cost of the airplane has been determined and it has been produced for the market, a sales force is necessary. It is a question at the present time whether or not the sales manager should be a pilot. The weight of opinion seems to be in favor of the flying sales manager. This is probably due to the fact that the industry is still young and the majority of the planes are still sold to pilots who wish them demonstrated in the air. As the industry develops, however, and chains of dealers and branches are distributed over the United States and foreign countries by some of the large concerns, the sales manager will probably not be a pilot but a so-called ground flyer.

The big contracts will be handled by operating companies and those that are made through direct sale will be engineered by business men of high caliber who will have a pilot and plane of their own to take them wherever they wish, for it seems more business-like to talk to the big customer on the ground while the pilot is demonstrating the plane in the air above. The contract itself will probably be closed in the office of the sales manager where figures for operation, performance and so forth can be placed before the customer. Consequently, the present is the day of the flying sales manager; the future, that of men with marketing experience who can plan sales campaigns and direct from a centralized office the activities of those in the selling field.

Advertising will play a prominent part in the future sales of aircraft. Its first function will be to make the general public air-minded and the second to sell the product itself. Paradoxical as it may seem, pilots make poor advertising men; and the best that have been brought into the industry have been those who have not been bitten by the "flying-bug" but who have grasped the language of the pilot, combined it with a sense of business requirements and imparted it to the trade in smart copy carried in carefully selected magazines.

The present era of aviation is not that of the pilot and inventor but that of the business man.

Though I have every faith in the future of aviation and believe that great fortunes will be made by a few of the leaders, it is my personal belief that a number of young men, and in fact older men, are giving up positions of responsibility carrying with them a good remuneration in favor of lesser positions in the aeronautic industry, when they should have retained their previous connection instead of being lured away by the expectation of becoming captains of industry. Consequently, while there are a great many opportunities in aviation, one should be absolutely sure that he is fitted for this field and that by making a connection with some aircraft manufacturing concern he will better his position.

Your Chance To Get Into AVIATION

Let Major Rockwell Train You AT HOME

A War Flyer Will Teach You

Major Rockwell is a famous war flyer. Decorated with the Legion of Honor and War Cross. He will teach you from his own experience learned on the battlefields of France.

I have prepared a very practical Home Study Course in Aviation that gives you a sound and complete knowledge of Aviation in all its fundamental phases. My course covers such subjects as the Principles of Flight, Construction, Control, Rigging, Assembly, Motor Designing, Operation, Etc. These subjects you should know before you are ready to take your place in Aviation either as a pilot or in many of the well paid ground jobs. After taking my Home Study Course you can arrive at your Aviation Goal much quicker and easier.

No Special Education Necessary

You don't need a high school or any Special education to master my course. It is so thorough and complete and everything is so clearly explained in text, diagrams and pictures that in a few months you will be able to grasp the principles of Aviation ground work and be well on the road to qualify for an important Aviation job. My Home Study Course will give you all the knowledge necessary to pass the government's written examination for mechanics' or pilots' licenses.

Students Praise My Methods

W. C. Rickels says "after I completed your ground course which prepared me in the principles of flight I was able to solo in 7 hours." Floyd Prothero says "your method of instruction not only gave me a thorough knowledge of Aviation but you also showed me how to capitalize on what I learned."

Employment Service

After you graduate I assist you in getting a job without any cost to you. Right now the demand for trained men is greater than the supply. A place is ready for you! I am so sure that you can learn Aviation with my help and step into a big Aviation job that if you are not satisfied when you have finished my course, I agree to return every penny of your tuition.

This Book Free

Mail the coupon for this Book that explains my course fully and answers your every question about Aviation and how you can enter it easily and quickly.

Major R. L. Rockwell,
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Dayton, Ohio.

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ON THE TEST BLOCK

[*Continued from page 20*]

and reliable performance. As a further service to the aircraft engine manufacturer, a field representative of the Bureau of Standards has been designated as a go-between of the Aeronautical Branch of the Department of Commerce and persons and firms engaged in the development, testing, production, and inspection of commercial as well as military aircraft engines.

Dr. Dickinson has outlined several causes of aircraft engine failure: mechanical and structural failures, failure of fuel supply, failure of ignition, failure of cooling system, the mechanical stresses of engine speed, and the use of fuels which "knock" may result in over-heating, pre-ignition, spark-plug failures and in extreme instances major mechanical breakage. Failures of the power plant, according to statistics, are responsible for less than 20 per cent of the causes of airplane accidents.

However, Dr. Dickinson is of the opinion that faulty functioning of an engine may be responsible for some of the accidents now blamed on pilots or other operating personnel. "It is," Dr. Dickinson points out, "doubly important, therefore, that every practicable means should be used to protect the pilot and his passengers where they can not protect themselves, namely, in the matter of power plant safety."

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Manager Flight Training Division

Army Pursuit Pilot, graduate of famous Kelley Field, Kelley's five years continuous experience as a flying instructor with 3,000 hours at the stick directs your flight training at Airtech.

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The experience of Airtech's master pilots, who will be your flying instructors, supported by an efficiently departmentalized organization specializing in aeronautical training, is your assurance of the finest instruction available.

Each member of the Airtech faculty will give you the specialized knowledge gained from years of experience in the aviation industry.

Airtech Training is Thorough Training.

"FIRST IN THE WEST"
Approved by the Department of Commerce for all classes of Flying and Ground School Instruction.

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240 hours Ground School.

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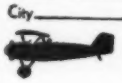

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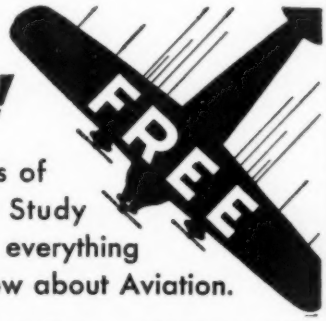

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The Third All-American Aircraft Show will be the greatest event of its kind in the history of aviation.

At the Detroit City Airport, April 5-13, all the leading airplanes of the Western Hemisphere will be displayed under one roof on the spacious floor of the new million-dollar municipal Hangar.

The All-American Show is planned for your convenience. The Airport is in the heart of Detroit—quickly reached from downtown hotels by automobile, bus or street car.

You can examine the ships at leisure on the exhibition floor—then step out to the flying field, directly adjacent to the Hangar, and see them demonstrated in the air.

No other show offers you a similar opportunity. Plan now to attend.

For full particulars apply to

RAY COOPER, Manager
AIRCRAFT BUREAU
DETROIT BOARD OF COMMERCE

THE AERIAL DRUMMER

[*Continued from page 27*]

a-car firms, but solely to accommodate the flyers.

The airport operator profits from the sale of gasoline and oil to the flyer. These are large items and receipts will be in heavy volume. An airman buys his fuel in large quantities. This does not imply that flying is more expensive than travelling by automobile or train. Before making a 500 mile flight the airman will fill his tanks with at least 60 gallons of gasoline. His plane, if equipped with a 150 hp. motor, will average over 100 miles an hour at cruising speed. He can fly 500 miles between meals. By automobile the trip would average a day and forenoon of hard driving. The motorist buys four of five meals en route and pays a hotel bill for a night's lodging. Entirely aside from the question of valuable time saved, it may safely be said that airplane travel will prove far less costly than other means.

There is every indication that manufacturers are coming to use cabin planes as portable sample rooms and show rooms. Use of automobiles in this capacity is increasing. The greater mobility of the airplane and its ability to stand up on its hind legs and attract crowds, especially in small towns, will bring about its general adoption.

To handle this type of work a number of planes are being built with special equipment, including display drawers and unusual lighting effects for night advertising.

Exploitation managers may be overlooking a good bet by not "sampling" towns from the air. If ordinances prevent dropping small objects over the city, they may be dropped around the edge of town so that they will fall just outside the city limits where people can come out and get them.

If the samples are too heavy to be dropped safely they may be hooked on to small paper parachutes which are designed for advertising purposes and can be purchased at a fraction of a cent apiece. Sampling from the air holds innumerable possibilities for ingenious advertising.

The radio sales promotion manager will find the airplane particularly advantageous in his work. He can equip a plane with a modern light-weight, highly amplified loudspeaker such as have been used with marked success from the air. So equipped, he flies over a town on his route, switches on the set, and announces to the world below that he is representing Blank and Blank radios—"The clearest voice in America."

His aerial spiel could go something like this: "I am here to see Mr. Jones of the Jones Radio Shop. Will Mr. Jones please come out to the local airport right away? Anyone else interested is cordially invited to come out to the field and inspect the new Blank double grid plated, etc., radio. I will now give you a fifteen minute radio concert from a beautifully finished, highly selective and soft toned Blank radio." With this he tunes in on a radio set in the plane and broadcasts the music through the amplified loudspeaker. He intersperses the program with a sales discourse on the superlative merits of Blank radios.

He may expect to create a tremendous sensation because of the utter novelty of the demonstration. And he may expect a large crowd at the airport to inspect his sample sets.

This system of advertising would be applicable to many commodities. The radio is used only as an example.

Such a stunt is a good prestige builder for the manufacturer and his local dealer. Never before have the local citizens been called upon from the sky. It could not fail to impress everyone, no matter how calloused or indifferent they have grown to the ordinary run of everyday advertising. The stunt should be good for publicity in the local press.

Furthermore the broadcaster could do much to promote aviation as he flies. En route to a destination he can take a few minutes to circle a town and announce that he fails to see an airmark or airport. "I would like to sit down and stay awhile because from the air it looks like a home-like, hospitable town. I wish you had an airport here. It is a great advertisement for any town and a big help to us fliers."

He follows with his usual sales spiel and expresses the hope that all double-action Blank grid radios in the town are giving their usual clear-cut reception.

Such a visit would be much less expensive and more effective than an organized campaign conducted on the ground.

I understand that small broadcasting sets which can be operated by the pilot himself are being placed on the market at comparatively low prices.

The name of the manufacturer and trade mark of course are displayed prominently on the plane, adding the

effect of visual to aural advertising.

Again we find infinite possibilities in the airplane as a sales promotion medium.

However, the flying salesman is dependent to a large extent on adequate ground facilities. Thus the auto-aircraft operator, the man who will run the private airports at small cities, steps into the picture.

To facilitate aerial advertising and sales promotion these airport operators will find it to their advantage to install sample rooms, such as hotels maintain for salesmen. This idea is already being carried out in many metropolitan centers and will spread to smaller airports.

It will remain for auto-aircraft operators to introduce private flying on a large scale in many small towns. From the beginning it will pay him to maintain a plane of his own. On Sundays he can hop passengers. He can add the revenue from sales of gasoline and oil to the motorists who visit the field. In time he will see his way clear to launch a flying school and take on a good airplane agency. Thus he edges his way into the profitable aeronautical business with small initial investment while maintaining a plentiful reserve of working capital.

ENCOURAGING SALES SLUMPS

[*Continued from page 16*]

of a hard-boiled radio sales staff would be the best tonic that I can think of for the airplane industry. If this contact with the radio sales staff only convinced the airplane salesman that he has simply been playing at business, the time spent would mark an epoch in aviation. A radio man would give both his left and right eye for all the front page free publicity that has been given to aviation during the past 20 years, and yet aviation has realized but little on this publicity. In terms of other industries, aviation sales have never created popular demand. It has always been a matter of the customer crashing the gates for admission, or as the advertiser has it, "sales from direct leads."

To make matters worse, there has been little engineering development and very few outstanding improvements in the airplane structure since the war. Look the present day ship over critically, and outside of detail engine improvements you see practically the same thing as in 1920. True, "gas-pipe" has been substituted for the wood longerons of the old Jenny but in most essential respects it is a Jenny still. We have the cabin plane with us in increasing numbers but this is nothing new for there were cabin planes before and during war-times if you will go back to the time of the Avro, Christmas Bullet and others. Design has fallen into a rut with really original ideas scarcer than hen's teeth. The agent for the "Baco" has little new to offer that is not found as well on the "Zaco" and the market therefore lacks the stimulating effect of technical competition. What we need, as much as anything, is something to talk about, just as the radio industry successively promoted the regenerative, reflex, tuned radio frequency, super-heterodyne and screen grid circuits, arousing public interest at every turn of the wheels. This condition of affairs has been commented on publically by at least one well known airplane manufacturer and is a hopeful sign that may lead to early development.

There is, however, one new sparkling possibility in aviation that deserves more than a passing notice. This

To be Really Successful in AVIATION

requires the kind of training you get at **MARSHALL**

At Marshall, the original "College of the Air", you receive COMPLETE instruction in every phase of Aviation. Extensive ground courses, as well as actual flight instruction, fit Marshall students for executive jobs in this new industry.

Here you will be trained in the Barling NB3 low wing monoplanes, and other new production planes . . . here you are really EDUCATED in Aviation. Do not fail to investigate the opportunities afforded by this splendid school to receive the highest type training at a reduced cost.

MARSHALL FLYING SCHOOL
Marshall, Missouri

Compare These Prices

Special 10 hour Flying Course	**$200**
Primary Aviation Course	**$275**
Sportsman's Course	**$475**
Professional Course	**$875**
Mechanics Course	**$ 95**
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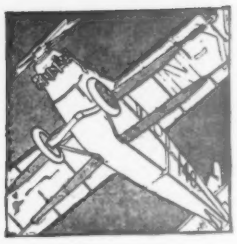

A New Record
for
Longines

Over the South Pole
with
Commander Byrd!

In their hazardous flight over regions of ice, where a compass was useless and operations were governed by minutes and seconds of time, the Byrd Antarctic Expedition relied most successfully on their Longines scientific timing equipment.

This marks the tenth aviation record established during 1929 with the aid of Longines timepieces!

A. Wittnauer Co.
Est. 1866
402-404 Fifth Ave.
NEW YORK CHICAGO
MONTREAL GENEVA

is the glider or sailplane that will undoubtedly duplicate its European popularity in America. Glider clubs are being formed all over the United States, and while the majority of the present gliders are of the homemade variety, there will undoubtedly be a demand for a factory-built product in the near future. As a sport it offers all the pleasures and thrills of the airplane at a very moderate cost, and having once been lured into aviation and trained to actual flight by the sailplane, the owner will naturally advance to the powered airplane stage. This is exactly the same thing in principle as the five dollar crystal radio set that eventually led to the purchase of an advanced superheterodyne receiver. The glider will undoubtedly be the silent salesman for the airplane in very many cases.

Light airplanes, the logical successor to the glider above, have always been ignored by the large airplane manufacturer, and the few that have been produced are largely in "kitchen sink production." Once divested of his "big business" ideas along the conventional lines followed at present, there seems to be no reason at all why large scale production of a light plane selling at from $1,200 to $1,500 would not prove a profitable adventure just as the Ford Model "R" proved when it broke into the ranks of the DeLuxe cars in 1907. This light type not only appeals to the novice but is useful in a dozen different branches of aviation. Where there is one prospective purchaser for a $5,000 plane there are 10,000 prospects for the light plane that is sure to come in time. Why not anticipate this market, supplying what is really a demand among the greater percentage of the population, rather than to encounter the sales resistance and limitations of the present market?

A BANKER'S VIEWS

[*Continued from page 18*]

(8) Miscellaneous companies, such as Underwriters and Credit corporations.

It is not my purpose to describe the individual companies composing these divisions or groups. Three of them are outstanding. The main interest of one lies in transport companies owning government air mail contracts, although it also controls plane manufacturers, and rights to various aeronautical motors and terminal properties. It is undoubtedly well financed and well organized. This company will always act as a holding company or investment trust, forming subsidiary companies when necessary in order to engage in fields of active operation.

The second of the three largest companies, controls manufacturing units exclusively, while the third is interested in motor and plane manufacturers as well as in transport companies. All three of these holding companies are strong financially and have the best interests of the industry at heart. There are in addition, of course, other holding companies some of which have undoubted strength and some of which might not be considered quite so strong from a banker's standpoint.

When it comes to manufacturers, there are roughly speaking close to 2,000 in the United States, and probably several times this number when all the little shops are considered, who are engaged in some sort of production having to do with aviation. Some of these are very large—such as the leading plane and motor manufacturing plants—and some are very small, about on a par with the bicycle shops of the early days. The larger companies are well financed and have ample capital. About 60 of the manufacturing companies produce finished planes that are recognized as worthy ships.

While no figures—official figures—are yet available for the full year of 1929, the figures up to July 1st are now published. These show that there were 45 air transport lines operating at that time. These lines had 400 planes in service, an increase of 100 within the first six months of last year. Of these, 30 lines were flying passengers between definite points on 178 regular daily schedules. During this period the transport planes flew an aggregate of about 8,000,000 miles, which was between two and three million miles more than during the corresponding period of 1928. In addition, it is believed that miscellaneous planes, not flying regular routes, covered a mileage of about 40,000,000. The average of daily flights over transport lines in the first half of 1929 was 70,000 miles and by the end of the year this had been increased, according to unofficial estimates, to 84,656. The total length of the airways of established lines was 30,000 miles, and of these 10,183 miles are lighted for night flying. Indeed, a daily average of 20,000 miles is flown at night.

During the first half of 1929, 1,200,000 pounds of express packages were carried by plane. Up to November 1 it is estimated that 1,750,000 pounds of express and freight had been shipped via air during 1929. In addition, for the first 11 months, 5,500,000 pounds of mail had been transported by air. During the same period 60,000 passengers

had been carried for hire. Such are the figures of air transport!

When it comes to airports there are, according to latest figures, 466 private and commercial ports and 456 municipal ports. In addition, there are 1,269 exposed airports, and 37 radio communication stations.

On August 1, there were 8,569 licensed airplane pilots in the United States, of whom 70 were women. On the same date there were 12,224 licensed airplanes for both commercial and private uses. In addition there were 575 aeronautic schools. The total value of all air products for 1929 is believed to have been between $80,000,000 and $100,000,000. Such are the statistics of aviation today!

What of the financial aspects? As I stated at the beginning of this article, aviation has now reached the eighth stage in its climb upward—the stage of *demand*. Next must come adequate financing.

Before that can be accomplished aviation must be made to show attractive profits for the investor. It has not done so as yet, except in scattering intances. Yet, with the "corrective deflation" now in progress, and with the great consolidations that have occurred, bringing new strength to the industry, there seems to be no reason why aviation will not before long command capital to the same extent that the automobile industry commanded it at the same relative stage of its upbuilding.

Meanwhile, the government has been insisting that there be a "revision downward" in the air mail rates paid by it to the transport companies and the latter, in their turn, have expressed a willingness to meet the postal authorities half way. In other words, the transport companies must expect less revenue from this source than formerly. This deficiency must be made up in some way, and it seems that the only sensible way in which this can be done is through the encouragement of more express freight service through a lowering of rates that will enable planes to compete with the other express freight carriers.

Passenger fares have already been lowered to a point where the air lines can now compete, in many cases, with the railways, Pullman fares included. It seems quite obvious, therefore, that the future revenues of the air lines must come from the handling of more express freight at less cost.

As to the marketing of planes themselves, the courses are well defined. First, we must have greater safety. It is true that the airplane does not have as many fatalities or serious injuries per mile as other types of transportation, but the fact remains that millions of people are still afraid of it. Educational measures must be adopted to sell the safety of the airplane to the public and, in the meantime, every effort must be made to eliminate accidents and disasters. If the public could be convinced that airplanes were safe, there would be no difficulty in getting millions of people to use this mode of transportation. Through the publication of the causes of disasters, great strides have already been made in this direction.

Next, of course, we must have more and better landing fields and airports—ports that are more accessible to the business districts of our cities. And, finally, we must if possible eliminate the hazards of weather and the danger inherent in fogs—problems that scientists, and not bankers, must solve.

Eventually we must, and of course will, follow the lead of the motor car industry, and make it easier for people to buy planes. This means that reliable planes must be built that will sell at lower prices than now obtain. It also means that installment selling must be practiced on a large scale and that some means must be found whereby used planes can be "traded in" for new ones. These things, however, already

USED Airplanes FOR SALE

BY THE SOUTHERN AIR TRANSPORT, INC.

Name of Ship	Type	Open or Cabin	No. of Pass.	Ship No.	Motor Time	Ship Time	Motor Type
Stinson	Mono	Cabin	3	NC4728	141	691	J-5
Ryan-Brougham	"	"	3	NC3910	274	274	J-5
Lockheed	"	"	5	C306H	28	28	Wasp
Travel Air	"	"	6	C9083	39	443	J-6
" "	"	"	6	R8159	210	221	J-6
" "	Biplane	Open	3	C677H	74	64	J-6
" "	"	"	3	NC691K	40	36	J-6
" "	"	"	3	NC680H	72	61	J-6
" "	"	"	3	NC5398	218	640	OX-5
" "	"	"	3	C8101	97	381	OX-5
" "	"	"	3	C8154	62	327	OX-5
" "	"	"	3	C8172	376	462	OX-5
" "	"	"	3	C8858	20	204	OX-5
" "	"	"	3	C9803	287	494	OX-5
" "	"	"	3	C9805	252	128	OX-5
Command-Aire	"	"	3	NC443E	81	81	OX-5
" "	"	"	3	NC521E	96	83	OX-5
" "	"	"	3	NC523E	187	332	OX-5
" "	"	"	3	NC524E	122	141	OX-5
" "	"	"	3	NC577E	200	195	OX-5
Curtiss-Robin	Mono	Cabin	3	C369E	38	189	Challenger
" "	"	"	3	C8334	10	133	Challenger
" "	"	"	3	C8367	338	308	Challenger
" "	"	"	3	C9223	140	116	Challenger
" "	"	"	3	C9229	222	198	Challenger
" "	"	"	3	C9246	263	208	Challenger
" "	"	"	3	C9254	84	188	Challenger
" "	"	"	3	C9260	194	163	Challenger
" "	"	"	3	NC370K	185	166	Challenger
" "	"	"	3	NC371K	114	96	Challenger
" "	"	"	3	C9226	13	12	OX-5
" "	"	"	3	C 79E	28	137	OX-5
" "	"	"	3	C123E	440	362	OX-5
" "	"	"	3	C321E	155	149	OX-5
" "	"	"	3	C7505	61	426	OX-5
" "	"	"	3	C8313	277	241	OX-5
" "	"	"	3	C9222	44	39	OX-5
Fleet	Biplane	Open	3	NC8640	197	479	Warner
"	"	"	3	NC9432	200	216	Warner
"	"	"	3	NC9431	251	442	Warner
"	"	"	3	NC9430	140	332	Warner
Kreider-Reiser	"	"	3	C296K	62	54	J-6
" "	"	"	3	C292K	0	0	J-6
Davis	"	"	2	C533K	17	14	LeBlond "60"

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SOUTHERN AIR TRANSPORT, Fort Worth

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Please send me your Free Book, showing how I can learn Aeronautical Drafting right at home. A-6

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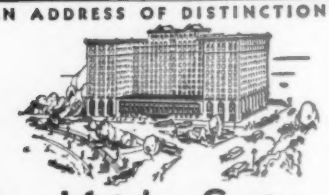

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practiced to some extent, are certain to come because American business is now done in that way.

Financially speaking, it seems to me that the bigger and stronger companies are already following the proper course. They are — through consolidations — placing the industry on a sounder basis. They are making it more attractive to the investor and, of course, to the banker. They are doing their utmost to build well, avoiding over-expansion in every way possible.

Looking ahead, I do not see how it is possible for aviation to do anything but advance. Its future, if kept in good hands, will be great and its advancement rapid. It cannot be otherwise. Already we see the realization of Alfred Tennyson's poetic vision, as expressed in these immortal lines:

"For I dipped into the future far as human eye could see,
Saw the vision of the world and all the wonder that would be—
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales."

WINGS FOR HAWAII

[*Continued from page 23*]

Union Airlines—a holding company for West Coast Transport and for Capital Airlines—are the other directors, together with C. C. Pittman, owner of the Universal Motor Company, Honolulu.

With all this fine equipment and sound financial backing, complications of American government will prevent Hawaii from profiting by these facilities for air mail communication, at least for another year. Washington so far refuses to supply funds for carrying air mail on these privately owned ships in the territory, largely on technical grounds, and the Territorial Government cannot interfere with U. S. Mail, so it appears. It will require time to unravel these knots.

In the meantime wealthy planters and enterprising young men see new use for the airplane and seaplane for development and operation purposes, now that airports are established on all the principal islands.

At Kaui, noted for its sugar but little favored by planters on account of its great distance from the other islands, Hanapepe airport solves that difficulty. From Rodgers Airport to Hoolehua airport on Moloka island, famed for its homesteads and its pineapples, is now only a matter of 36 minutes. A planter can come into Honolulu for the theater and fly home afterward in the still Hawaiian night if he has his own plane.

All of little Lanai is owned by the pineapple company, so planes only stop on signal at Lanai City field. Now the company will run its own planes instead of wasting time of directors on motor boats.

The sugar and cattle resources of Maui island are now only an hour and a half out of direct touch with the main seaport—if we add 15 minutes to the flying time to Rodgers Airport—thanks to the facilities of Kihei Airport at Maui. Those who have experienced this great saving of time are as loath to go by boat as the average person is to walk when he can ride in an automobile.

"More than this," says Rilley Allen, whom Hawaiians have lots to thank for in this matter of wings, "the air brings world people as well as island people closer together. We no longer feel that we are just a group, mislaid way off in the Pacific. We feel close to the mainland, nearer than California was to the Mississippi before the air brought them together. It has been proved to us that we are close and nothing can take this certitude away from us Americans of the Near Orient."

HELIUM PRODUCTION

[*Continued from page 37*]

To the surprise of the expectant crowd the gas not only failed to ignite but actually put out the bonfire. Then it was realized that here was a gas which, under those conditions was non-combustible.

An investigation was started immediately by the University of Kansas. Under the supervision of Dr. H. B. Cady and David McFarlane samples of the gas were tested and it was found that the gas was almost two per cent helium, which for several years remained the highest helium content known to any gas.

This discovery started a rather elaborate survey, and helium was found to be present in some natural gases (not all) in quantities varying from a mere trace to 2 per cent. However, at the

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beginning of the World War helium was still a very rare gas because of the difficulty of separating it from natural gas and minerals. There were in existence in the United States at that time not more than two or three cubic feet of isolated helium, and in Europe about eight cubic feet. It was used only for scientific experiments, the cost which was $2,500 a cubic foot, making it prohibitive for commercial purposes.

During the war before American entered, great trouble was experienced in keeping hydrogen-filled observation balloons in the air. Stationary balloons had acted as eyes for the army for many years, but the arrival of airplanes, equipped with machine guns, killed the effectiveness of balloons. One bullet, of incendiary type from an airplane brought down balloon, men, data, and all. Then it was that the military world called upon the scientific world to supply a non-combustible gas for inflation of balloons and dirigibles.

Ramsay, realizing that the United States controlled the world's supply of helium, called upon this country to investigate the possibility of securing this rare gas in sufficient quantities for this purpose. It was a dual problem presented to American scientists. Not only a tremendous increase in production, but a great reduction in cost was necessary to final success. A comparison of the capacity of the Los Angeles which is 2,450,000 cubic feet of helium, with the amount of isolated helium in the world at that time, about 11 cubic feet in all, gives some idea of the problem of quantity. A consideration of what it would have cost to inflate the Los Angeles with helium that cost $2,500 a cubic foot gives some idea of their problem of cost of production.

Science faced a well-nigh hopeless problem, pondered it, then carried it through to commercial success. At the close of the World War an assignment of 250,000 cubic feet of helium was on the docks at New Orleans ready for over-seas shipment. This helium had been produced at a cost of 44 cents a cubic foot. Scientists, elated over the success of their undertaking, little dreamed that the astounding reduction of cost from $2,500 to 44 cents a cubic foot could be still further reduced. Today helium is released from natural gas at the Soncy Plant, six miles west of Amarillo, for less than two cents a cubic foot.

The process used to separate helium from natural gas is the familiar process of liquefaction. At a temperature as low as 300 degrees below zero fahrenheit natural gas is reduced to liquid form. Helium will not liquefy until a degree of coldness near "absolute zero" is reached. This absolute zero is commonly accepted as a little less than 459 degrees below zero fahrenheit, decidedly lower than the temperature required to liquefy natural gas.

Gas from the wells north west of Amarillo is piped into the plant under 600 pounds pressure. Carbon dioxide which is present in a small quantity in this gas is first removed. Then the gas is passed into the separation room where it is chilled by external means to a temperature of less than 300 degrees below zero. At this time all gases except helium are liquefied and are drawn off and the gaseous helium is collected in storage containers.

The liquid natural gas is then restored to its natural state and conducted into the ten-inch mains of the Amarillo Gas Company and used for fuel. However, in the process of restoration to its natural state the cold residue gas is used in chilling fresh gas, thereby serving a two-fold purpose.

Helium is shipped by rail in cars designed for this purpose. Each car has three enormous drums or cylinders, fastened firmly to the railroad chassis, pyramid fashion, two below and one

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above. The drums are 40 feet long, 52 inches in diameter, with walls 2 inches thick. They are gas tight with safety valves, and have a single in-let. Helium is compressed in these cylinders at 2,000 pounds per square inch pressure, ten times the pressure of a locomotive boiler. Under this pressure a tank will carry 200,000 cubic feet of helium when released to atmospheric pressure. The tank is tested to 3,300 pounds pressure per square inch. Each 200,000 cubic foot load of helium weighs approximately one long ton, or 2,240 pounds.

Helium is more practical for the inflation of dirigibles than hydrogen in several respects. Investigation has proved that helium possesses 92½ per cent as much lifting power as hydrogen. Since it will not burn the ship's engines can be placed with regard to the greatest efficiency and with disregard for proximity to the helium bags, a factor not possible with the use of inflammable hydrogen. Since it will not explode the morale of the dirigible crews is greatly strengthened.

Not the least of its advantages is the economy in the matter of refilling the bags. Hydrogen can be produced for $11 per thousand cubic feet, while it is true that the cost of helium is nearly $20 per thousand, produced by the first units of the Soncy Plant. But a hydrogen inflated ship in active use must be refilled about ten times a year, giving a cost of $110 per thousand cubic feet annually. This is due to the fact that air seeps into the bags, and hydrogen escapes. Hydrogen is dangerous when less than 90 per cent pure and can not be purified. When helium becomes only 85 per cent pure it is removed and purified at a cost of 50 cents per thousand cubic feet.

Commercial helium may be said to be an American product since no other country produces helium from natural gas. The only plant in the world operating on a commercial basis is the Soncy Plant in the Texas Panhandle. Forty square miles of gas bearing lands in the 2,000 square miles known as the Amarillo Gas Fields have been leased by the government to furnish gas for this plant. Official estimates state that gas from wells on this lease will last for 20 years.

While the most outstanding use for helium at the present time is the inflation of dirigibles, still this gas has been used successfully in other ways. It is now used in the rectifier tubes in radio instruments. It is proposed to use helium to cool the instruments which generate and transform electricity, thereby materially increasing their capacity. Deep sea divers hope to solve the problem of pressure at the depth of water where they must work by introducing helium into the air they breathe.

Helium is at the dawn of its economic history.

THE PUBLISHER'S QUILL

[*Continued from page 13*]

respecting public relations, especially as to the governmental factor, more progressive than were the early railroad companies."

It is true that we see many advantages to be gained by having the Interstate Commerce Commission or some such agency act as governing body over aviation transport. In much of the viewpoint of Senator Bratton, Congressman Cable, and other able proponents of government control, we have agreed.

Despite this, we came to the conclusion early that these advantages would be outweighed by other disadvantages which would make legislation at this time highly unwise, and might exercise on the whole a retarding effect on the growth of the air industry.

We still hold with this early conclusion.

Burning straw to inflate a hot-air balloon at Tempelhof.

WOMEN'S ACTIVITIES

EDITED BY LADY MARY HEATH

A Women's Aeronautical Association has been formed at Reno for the State of Nevada. An initial lunch was held early in the month of January for the purpose of forming this body. Mrs. McQueen, who founded the California Women's State Organization and the Women's International Aeronautic Association, was present. The large number of nearly 30 initial members joined from the State.

Miss Amelia Earhart, whose world's speed record still stands at 184.7 miles an hour in a Lockheed Vega plane, recently opened the Airport at Monterey, Cal. Miss Earhart was entertained by the leading women's organizations at San Francisco, after having flown a tri-motored Maddux plane from Los Angeles. The following day she addressed the San Francisco Advertising Club on the subject of "The Advance of Aeronautics." Miss Earhart was weather-bound at Albuquerque with her machine in which she flew in the International Air Tour Women's races.

Miss Eleanor Smith, whose women's endurance record with Miss Bobby Trout still stands, has returned home after her repeated attempts at raising the record time.

Mrs. Louise Thaden, winner of the Women's Air Derby, was a visitor at the Long Island Aviation Club.

Colonel and Mrs. Lindbergh have just crossed the Continent, exploring the T. A. T. Airports. They hope to remain at least a fortnight on the East coast before returning to New York. Mrs. Lindbergh recently took a pilot's license. She tested her husband's new plane with him at Los Angeles.

Miss Margaret Thomas of San Antonio, Texas, has been appointed demonstration pilot for the Curtiss Wright Flying Service of New York.

Miss Mildred Stinaff, who is employed by the General Tire and Rubber Company of Akron, is planning to take a train ride sometime in the near future as a matter of experience!

Of the women's air records that by Mademoiselle Bastie is first—she remained in the air for 26 hours and 47 minutes. By this performance she beat Miss Elinor Smith by a few minutes.

Miss Stocker took a new Eagle Rock out the day before Thanksgiving and looped it 28 times. She started at 5,000 feet and finished at 1,000 feet.

Miss Ruth Nichols, who has just completed 12,000 miles survey of the United States airports, reports that her Curtiss Fledgling took off the landed beautifully. She also reported that the general condition of airports varied considerably, from the best to the most poorly kept.

Miss Marie Lourdes has just acquired a plane for a flight from Lisbon to South America.

The Air Minded Branch of the Forum Club in London is going very well indeed. The following are heading this organization: Lady Bailey, Mrs. Forbes Semple, Lady Ellibank, the dowager Lady Swaythling, Lady Apsley, Mrs. Alan Butler, and Miss Cecily O'Brien.

Miss Kay Rosen recently flew solo at the Curtiss Field after only 4 hours and 40 minutes of flying. Next to Ruth Law this is in the nature of a record training period.

Two interesting aviation marriages recently occurred when Bessie Davis was married to Mr. C. H. Collin of Brooklyn, and Miss Frances Harrell, one of the well known women pilots in the Curtiss Wright Flying Service, was married to Mr. William Marsalis, flying instructor for the same organization. They have just returned from their aerial honeymoon.

Mrs. Keith Miller recently gave initial test flying at Mount Holly, N. J. Mrs. Miller was recently named chief test pilot for the Victor Company. It is understood that she reports very well on this new training machine.

Miss Maryland Jordan of Baltimore has been made Atlanta representative of the Interstate Air Lines, Inc.

The Aviation Club for Women was recently formed by 20 flying girls of Boston Airport. Miss Loraine Defren is President.

Miss Frances Brundidge, a producer of plays, Miss Meta Rotholz, a teacher of mathematics, and Miss Mary Van Cook, as well as Mrs. Laura Harney, are learning to fly at Valley Stream.

[*Continued on page 81*]

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MODEL DEPARTMENT

by Bertram Pond

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WORLD RECORD R.O.G.

AESOP or some similar wise man of the ages gone by once said that there was nothing new under the sun. This same old adage holds good with model airplanes today. There is hardly anything about models which has not been experimented with by the old time model clubs such as the Capital in Washington, Aero Science in New York, and Illinois Model in Chicago.

Model plane development hinges chiefly on refinements. Refinements are responsible almost entirely for the record breaking model flights of recent years.

Harold Denison of Marion, Ind., recently broke the indoor R.O.G. record officially with a flight of 178 seconds. A careful study of the R.O.G. model described in this article will reveal a number of the latest ideas for small indoor models. Even Denison's machine was not exactly like the one described in this article, for changes and improved details have made it possible to make even a better machine, and undoubtedly the record will be broken again soon by Denison or some other careful model airplane experimenter, for as you all know it really takes considerable experimenting to build a model capable of record performance.

Before building this model, study the drawings and descriptions very carefully. Some of the things to note, especially in this study, are as follows:

1. The wing has no counter-torque (wash in and wash out).

2. The motor base twists and in twisting warps the wing, giving it the correct amount of counter-torque at all times, causing the model to fly in a uniform circle.

3. The wing dihedral does not start at the center, but instead there is just enough dihedral at the tips for stability, and efficient modern detail of construction.

4. Note that the fin and elevator are mounted on an extension or boom. A kink which was developed in a famous series of 10-in. motor stretch indoor contests conducted by the Illinois Model Aero Club in about 1920.

5. Note that Denison, the present record holder, used a special rubber lubricant with his carefully built machine.

6. Note the shape of the propeller, especially near the tips.

You will note a number of other valuable ideas from the propeller to the tail as you build and experiment with the remarkable flying qualities of this model.

List of Materials

1-thrust bearing.

2-⅛-in. diameter light weight washers.

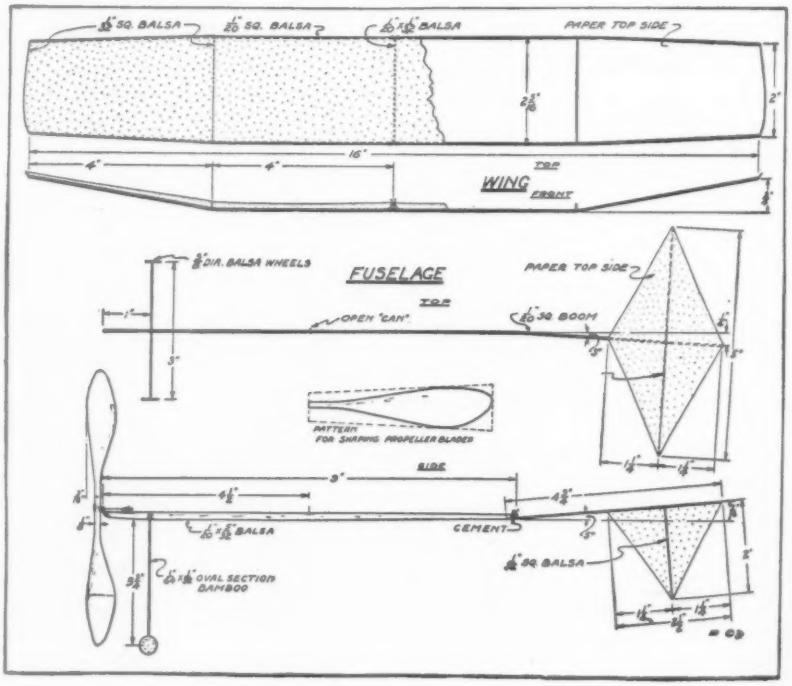
2-9-in. strips of No. 4 (013-in. diameter) rust proof toughest music wire to make the wire parts or one set of completed wire parts consisting of: 1 propeller shaft, 1 "S" hook, 1 can, 2 wing clips and 1 rear hook.

Transparent cement.

18-inches of tough fresh rubber 1/20-in. square. (Rubber bands are seldom as good as strip rubber.)

1-piece of extra light superfine Japanese tissue.

1-small piece of Tonkin bamboo for landing gear struts 3½-in. long.



2-3/8-in. diameter balsa wheels 1/32-in. thick.

1-balsa propeller blank 5/8-in. x 25/32-in. x 8-in.

1-balsa strip for ribs and elevator parts 1/32-in. x 1-in. x 6½-in.

2-balsa pieces for wing beams, motor base and tail boom 1/20-in. x 1-in. x 9-in.

Wing Construction

The cambered wing used on this model, you will notice, has a flat center section in the front view and the tips are bent upwards similar to wings of birds and the efficient little Barling monoplane. Note that the high point of the camber in the wing ribs is well forward as experiments in wind tunnels prove that low speed airfoils of this type are most efficient. Even Bleriot and many other early airplane designers and model builders knew of this fact.

Though the wing can be made straight in the top view you will obtain slightly better efficiency by making the wing tips to the shape shown.

The wing ribs should be made to the actual patterns shown in the drawing. Make the center rib 1/20-in. x 1/32-in. and the remaining ribs 1/32-in. square. The curve in the ribs is easily bent using a hot soldering iron or better, a balsa and bamboo bender. The wing beams should be 1/20-in. square, though the corners can be rounded slightly with sand paper. The wing beams can be cut from a piece of 1/20-in. thick balsa veneer by using a straight edge or ruler and a piece of sharp razor blade. For extreme lightness the wing beams in the bent up tips of the

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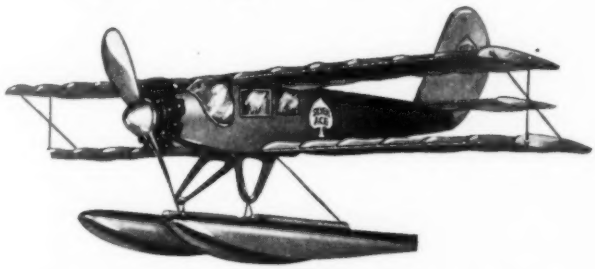

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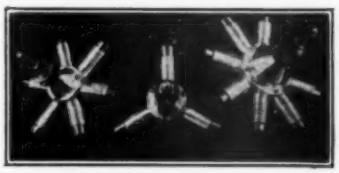

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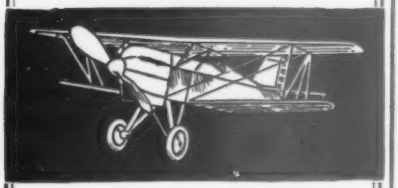

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wing can be tapered to 1/32-in. square at the tips.

The wing clips should be made very carefully so that they fit the motor base snugly without damaging it. Note that the front wing clip elevates the motor base 1/8-in. and the rear 5/16-in. Use the shape of wing clips shown as they were designed especially to grip the motor base. They twist the wing very slightly to counteract the torque of the rubber motor according to the number of winds.

Very carefully cement the parts of the wing together. An actual size drawing of the wing will speed up this work. In cementing the tips of the wing in place be sure that both tips have ¾-in. rise or dihedral. Note that the end ribs lean out slightly.

Cement the wing clips to the wing. The best way to do this is to slip the wing clips on the motor base and set the clips on the wing beams in their correct positions. Be sure that the shortest clip is at the front. If the wing beams are laying flat on a table this method will assure you that the clips are lined up. Cement them securely, leaving the motor base in position while the cement dries.

After the cement is dry remove the motor base from the clips and cover the wing with the smoothest and lightest Japanese tissue paper obtainable. A sheet of the finest model tissue paper weighs as much as one of these models complete so you can see that it is important to use a light, high grade tissue if you are expecting your model to make anything like a record flight. The paper should be cemented to the top of the wing beams and ribs. You will find it advisable to cover the wing in three pieces so as to preserve the camber between ribs. The two center sections can be one piece of tissue and the two outer sections should be separate pieces. Remember that a poor covering job may spoil the possibilities of a wonderfully constructed model. The wing when properly built should weigh about .017 ounces.

The Fuselage

A size of motor stick given in the drawing worked perfectly on Denison's record model with the particular grade of balsa wood he used. However, it may require a little experimenting on the exact cross section of motor stick to use so that the motor stick twist will be just enough to warp the correct amount of counter-torque into the wing. Make the can and rear hook to the exact pattern shown in the drawing. Cement these in place with transparent cement. Make two very thin landing gear struts from the bamboo piece. These struts should be of oval section and about 1/64-in. x 1/32-in. These landing gear struts should be 4¼-in. long. Cement them to the motor stick 1-in. from the front so that they will be 3-in. apart at their ends where the wheels are mounted. To save the weight of the wire axles you can cement the wheels fast to the bamboo struts, if you wish, as the rules to date have not specified that the wheels must rotate.

The motor stick tapers in height from 5/32-in. at the center to ⅛-in. at the rear. At the front a slight notch of about 1/32-in. depth is cut to prevent the propeller shaft from touching the motor base as it rotates. Cement the propeller bearing to the nose of the motor stick. For lightness, the propeller bearing should be cut off so that it is only about 5/16-in. long. The hole in the bearing should be set so that it is in line with the motor base, and 1/16-in. above the top of the motor stick.

Construct the rudder and elevator exactly as shown in the drawings. In papering the rudder and elevator a careful constructor will find it unnecessary to use a thread edging for attaching the paper. Just cut the paper after it is attached to the correct shape with a razor blade. Be very careful to mount the boom to the motor base at the angles shown in the drawing. This will assure you of a stable flying model. The angle of the boom to the motor base at the top view should completely control the size of the circle in which the model flies and glides regardless of whether there are any winds in the rubber motor or not. The completed fuselage should weigh about .023 ounces.

Propeller

Carve the propeller in the usual manner from a light weight balsa block 5/8-in. x 25/32-in. x 8-in. This gives a pitch of approximately 20 inches. After the propeller is carved and sanded down to the stage where you are ready to round the tips and cut out the hub you should check the rear face of the propeller blades very carefully. The best results are obtained if the blades have a very slight camber with the high point slightly in front of the center. Now using a paper pattern, cut both propeller blades to exactly the same

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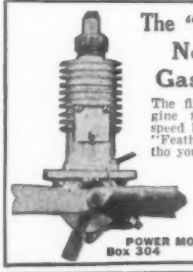

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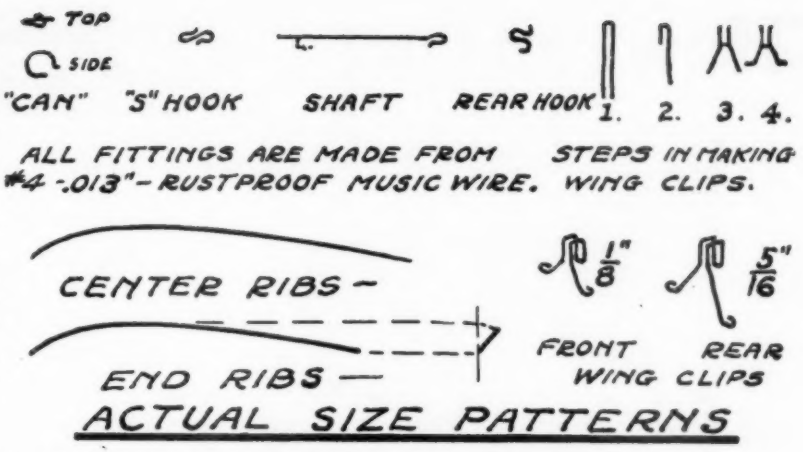
shape. Notice that the propeller hub is cut down in height both from the front and from the rear. Install the propeller shaft and cement it in place, properly aligned. The hook at the rear of the propeller shaft should be the smallest that you can possibly slip through the bearing, as on this model the "S" hook attaches to the propeller shaft rather than to the rear hook. This prevents the rubber from twisting around the propeller shaft and causing the propeller to wobble in flight.

The propeller blades should be very thin. In fact, so thin that they will flutter slightly if you blow your breath against them. Also the propeller should be very carefully balanced as a considerable loss of efficiency results from a propeller that is out of balance. The completed propeller should weigh about .014 ounces.



Motor

The motor should be made of pure strip rubber 1/20-in. square. If you expect to make good flights with this model, avoid the use of rubber bands as they are usually uneven. Since a chain is no stronger than its weakest link you may be carrying a load of dead weight into the air if you use a common type of rubber band motor.

Tie a knot in the rubber very securely. If you expect to use lubricant which will be almost necessary if you want to make long duration flights, the knot should be doubled, tied closely with several turns of silk thread and further secured if convenient with a drop of good rubber cement. This precaution is necessary with lubricant, especially if you use the latest lubricant such as Denison and Culver used in breaking the R.O.G. and 15-in. indoor records, respectively. The two strand motor for this model should weigh about .019 ounces lubricated.

Flying

Slip the parts together and hook the motor in position. Sight the front edge of the wing to see that the wing is perfectly straight. Then glide the model. If it stalls, slip the wing to the rear and to the front in case of a dive. When the model glides smoothly wind the propeller a few turns by hand and try again.

If this trial proves satisfactory you are now ready to put a larger number of turns into the rubber motor with a winder. Remember that with the best rubber lubricant you can obtain almost twice as many winds on tough rubber as you can with the same motor without the lubricant.

Joseph Culver renewed an old stunt by launching his model close to the floor. This gave him more effective height for his model to climb. You can use this method in case you wish to use this model, hand launched in a low ceiling room.

WOMEN'S ACTIVITIES [*Continued from page 77*]

Mrs. Joan Fay Shankle recently completed a transcontinental solo flight from San Diego to Boston in a Stearman, with a J.5 Wright Engine, in 30 hours' flying time.

Miss Spooner who recently acquired such a good place in the French Air Tour has now gone with Capt. Guest's party to British East Africa. Miss Spooner is at present visiting the Governor of Uganda in an endeavor to interest him in a local air line.

Miss Marjory Crawford, a well known golfer, swimmer, speed boat racer, and hunter, has amassed several hundred hours of flying time, and is organizing a club for girl pilots in Los Angeles.

Miss Frankie G. Renner, secretary of Robins Flying Service, Akron, Ohio, has received her certificate of life membership, and a perpetual license from the Federation Aeronautique International.

Mrs. W. E. Sawyer, secretary of a Flying Club in Jacksonville, Fla., is hoping to buy a machine for her club at an early date.

Park's Air College, East St. Louis, Ill., announces that it will hereafter admit women to classes on an equal basis with men. A night course for airplane and engine mechanics, to last 27 weeks, is offered, beginning Feb. 1.

Miss Vera Dawn Walker, who has just acquired her transport pilot's license, will demonstrate Pantha Engines for the MacClatchie Manufacturing Co., of Compton, Cal.

Mrs. Neva Paris, while flying to Miami, was killed when her machine went into a spin at Woodvine, Ga. Her loss will be greatly regretted as she was secretary of the newly formed

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FUTURE EVENTS

MARCH 6-16—Second Annual Pittsburgh Aircraft Show.
MARCH 17—Regional Airport Conference for New England, Providence, R. I.
MARCH 22-29—Second Annual Aviation Exposition, Buffalo, N. Y.
MARCH 22-29—Aircraft Show, Convention Hall, Camden, N. J.
MARCH 26-April 1—Cincinnati Aircraft Show.
APRIL 5-13—Third All-American Aircraft Show, Detroit.
APRIL 8-9—S.A.E. Meeting, Detroit.
MAY 3-10—New York Aircraft Show, Madison Square Garden, New York City.
MAY 14-16—National Conference, Airport Section, Aeronautical Chamber of Commerce, Buffalo, N. Y.
MAY 28-29—All-New England Air Tour, starting from Springfield Airport, Springfield, Mass.
MAY 30-JUNE 1—Dedication and Air Meet, Bowles Airport, Springfield, Mass.
JUNE 28—Annual R.A.F. Display, Hendon, England.
JULY 6—International Transportation Exposition opens in Poland.
SEPT. 1-6—Fifth International Air Congress, The Hague, Holland.
NOV. 27-DEC. 14—Aeronautical Salon, Paris, France.

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